SCIENCE.

FRIDAY, OCTOBER 30, 1885.

COMMENT AND CRITICISM.

THE NEW YORK *Evening post* of Oct. 21 publishes an editorial on the underground wire problem, in which a magnificent solution of the problem of burying the wires is offered. Along Broadway, just outside the curb line of the street, there is to be constructed a capacious underground gallery, wherein all the present impedimenta must be placed, and any obstruction which the workmen may encounter in the building of this gallery is to be removed. Herein are to be placed the steam, gas, sewer, pneumatic, hydraulic, and various other pipes, in addition to the wires of the various electric companies. The other streets of the city are to be tunnelled on a similar though less elaborate plan.

Magnificent as this plan may seem, it is hardly an exaggeration of what the underground commission actually proposes to require. They have caused it to be understood that they will consider no plan of placing the wires underground which does not combine all kinds of wires in a single conduit, with an arrangement by which access to every house may be obtained without excavation of the street. The question that interests the various electrical companies is, "Who is to undertake this extensive piece of engineering, and who is to pay for it?" Certainly, the commission has no power to construct such conduits, and, even if it had, it is difficult to see how the various electrical companies could be compelled to make use of them, or to pay for such use.

That it is not only technically possible, but economically practicable, to put the large mass of city wires underground, was admitted by the electrician of the American Bell telephone company, Dr. W. W. Jacques, in an article published in *Science* of July 3 of the present year, and the Metropolitan telephone company, whose mileage of wire in New York City is greater than that of any other company, has actually asked permission of the commission to put a part of its wires underground, and such permission has been refused. The reason why the wires in New York are not placed underground, and why they are not likely to be placed underground at present, is, not that it is technically impossible, and not that the parties operating them do not desire to place them underground, but because the commission insists upon its being done in accordance with an entirely impracticable plan.

IT WOULD BE INTERESTING to know just what evidence Mr. St. Pierre, the Canadian lawyer, who has recently given a theory of small-pox to the newspapers, has found, which leads him to the conclusion that small-pox is "indigenous to Canada," and "is to Montreal what yellow fever is to New Orleans, or ague to New Jersey." That it is to Montreal what yellow fever is to New Orleans we can well believe, for it is now conceded by the best sanitarians that yellow fever never appears in this country anywhere except when imported from abroad. And unless Mr. St. Pierre can give us something more reliable than Indian tradition, even though it comes from the oldest inhabitant, we shall be inclined to the now well-established opinion that small-pox was brought to this country shortly after its discovery by Columbus.

From the well-known aversion to vaccination which characterizes the French Canadian, we can well believe that small-pox has prevailed there in a more or less epidemic form so long that history fails to tell its first appearance, but we have no doubt that its termination would be very soon recorded if the vaccinators were permitted to have their way.

AGAIN THE PAPERS are flooded with paragraphs concerning great mortality of fishes in the Gulf of Mexico, and such headings as 'Twenty miles of dead fish,' or 'A fish pestilence in the Gulf.' Sensational as such notices at first sight appear, they can scarcely be pronounced to be exaggerations. Records show that as far back as 1844 a widespread destruction of all sorts of salt-water life occurred along our southern coasts; again in 1854, 1878, 1879, and 1880. It was in the winter of 1881–2 that a catastrophe of similar nature took place off

the middle Atlantic coast, and when 'windrows of dead fish' were reported by numerous vessels at various points between Capes Cod and Hatteras. At this time occurred the extermination of the tile-fish (Lopholatilus chamæleonticeps), discovered by the fish commission in 1879. Tens of thousands of these remarkable fishes, brilliant-hued, and as large as salmon, were reported floating dead at the surface; and diligent explorations made in 1883 and 1884, and during the present season, by the Albatross, show that it, together with many species of invertebrated animals with which it was associated, has entirely disappeared from the grounds where, at the depth of 80 to 150 fathoms, it was formerly very numerous.

Strangely enough no adequate theory has been advanced for the explanation of these phenomena. The 'poisoned water,' as it is called, in which the dead fish are seen, seems to be limited in its areas, and chemical analysis fails to reveal any thing peculiar in its composition. Extreme cold, which in severe winters has produced similar destruction among shore species, like the tautog in New England, can scarcely have been a factor in the 'fish pestilences' in the Gulf. Some of the most careful students of the problem have resorted to the hypothesis of earthquake shocks and the eruption of volcanic gases under the sea. The question deserves careful study at the hands of both physiologist and physicist.

That Montreal, as the educational centre of Canada, is likely to become more conspicuous in the near future, and that Canadian science is to take a higher position before long, are both indicated by the recent important changes which have occurred at the leading university of the dominion. The medical faculty have just completed additions to their building, which give most important advantages, especially in laboratory work, hitherto beyond the reach of the Canadian student. One of the most important of these changes is the provision of a special pathological laboratory and culture rooms, where investigations concerning the pathogenic importance of bacteria and allied forms will be prosecuted. The work is in charge of Dr. Johnson, a zealous student of pathology, fresh from the laboratory of Koch. In the arts faculty, also, an additional course in vegetable histology, under Prof. Penhallow, has been provided. Altogether, the future promises well for increased activity in biological research in the dominion.

Under the heading, 'A boat that hopes to go to Newport and back, at a cost of eighty cents for fuel,' we have recently seen a description of a boat said to be 100 feet long, 12 feet beam, and 75 tons burden, now in process of construction at the ship-yard of Mr. Poillon in New York City. It is presumed that the 'going to Newport and back' means that the craft is to be propelled through the waters of Long Island Sound from New York City to Newport and back again; and when we are told that this is to be accomplished at great speed, and at a cost of only eighty cents in fuel, by employing a method of propulsion which consists in firing blank cartridges from stern-ports under water, the absurdity of the whole thing renders it undeserving of notice. But this, like some other remarkable inventions for saving fuel, seems destined to re-appear at intervals, with the usual result,—somebody made wiser by dearly-bought experience. Not only is the proposed mode of propulsion radically defective, and inefficient in theory, but it has been experimentally demonstrated to be utterly unavailable for any useful purpose whatever in connection with navigation.

TYPHOID FEVER AND ITS PREVALENCE IN AUTUMN.

The causation of typhoid or enteric fever is involved in great obscurity. Some of the best authorities believe that it may originate *de novo;* in other words, as the great exponent of this theory, Dr. Murchison, states it, "the poison of enteric fever is contained in the emanations from certain forms of putrefying organic matter," and "is often generated by fæcal fermentation." Other authorities, equally good, hold that the appearance of typhoid fever cases necessarily presupposes the existence of a case which stands to the later ones in the relation of cause to effect, and that, if this case is not discovered, it is simply because the evidence is obscure, or the investigator inexperienced. Unfortunately the identification of the typhoid germ has not yet been satisfactorily determined, and until it is we can hardly expect the mystery now surrounding the production of the disease to be cleared away.

In regard to the means by which the fever spreads, there is more unanimity of opinion. The water of wells which has become impure from the leaking of vaults and cesspools has been shown over and over again to have caused typhoid epidemics. Notable instances of this have occurred in our own country, as in Syracuse in 1876, and the more recent epidemic at Plymouth, Penn.

Milk has also many times been the medium through which the typhoid poison has been disseminated. Impure water has been used to wash out the milk-cans, if, indeed, it has not served other purposes, and the milk has thus become infected. A striking example of this medium of contagion was the outbreak of typhoid at Marylebone, London. Within a few weeks 123 families were attacked. Mr. Radcliffe traced the cause of this outbreak to milk, which came from a particular farm on which "water used for dairy purposes contained excremental matters from a patient suffering from enteric fever, immediately before and at the time of the outbreak."

Epidemics occurring at Edinburgh, Glasgow, Bristol, and Dublin have also been traced to milk. These facts should stir up all health officials to the vital importance of the most rigid scrutiny of the milk supplied to the people under their charge, and should lead our judges to inflict the severest penalties upon those detected in the adulteration of this most essential food.

That this disease may be contracted by those who nurse the sick is possible, but if this ever occurs it is extremely rare. The discharges from the intestine are believed to contain the infective material; and in the present state of our knowledge to bury these discharges in the ground, or to cast them into the sewer without previous disinfection, must be looked upon as criminal. It is not difficult to understand that the infective material of such undisinfected discharges may cling to the interior of drain pipes and sewers, and through defective plumbing find admission to the dwelling and sleeping rooms of the well. This is doubtless the explanation of the origin of those cases which are ascribed to sewer-gas.

Typhoid fever is eminently a disease of the autumn, and its greater prevalence at this season of the year is attributed by some to the decay of vegetation; others claim to have found its prevalence to depend upon the rise and fall of the ground water. Just how far these conditions affect the prevalence of the fever is a matter of conjecture, and as they are entirely beyond our control we must in our endeavor towards prevention and restriction pay strict attention to cleanliness in all its forms, and especially to the thorough disinfection of the discharges from patients. For this purpose the committee on disinfectants of the American public health association recommend solutions of chloride of lime, of chlorinated soda, or of bichloride of mercury.

In our cities the typhoid patients are largely recruited from the ranks of those of ample means, who during the summer spend their time in the country, and often at the most fashionable watering places. It is notorious that these resorts are, as a rule, unsanitary in their appointments. The crowding of human beings in such places, with the consequent accumulation of human waste, would, it would seem, help to account for the large representation of typhoid fever victims in the ranks of their patrons. A study of typhoid cases with reference to this point would be interesting and doubtless instructive.

MAN AND THE MASTODON.

THE finding of the tusks, teeth, and portions of the skull of a mastodon last November in Northborough, Worcester county, Mass., has led to the important discovery of a human skull, in close connection with the remains of the mastodon. The facts briefly stated are as follows: Mr. Wm. U. Maynard, while having a ditch dug through a peat bog on his farm in Northborough, near the Shrewsbury line, last November, found portions of the skull and teeth of a mastodon lying on the hard pan under eight feet of peat. The specimens were exhibited to the members of the Worcester society of natural history and Worcester society of antiquity, by Dr. F. W. Brigham, to whom they had been given by Mr. Maynard. The teeth were afterwards taken to Cambridge by Mr. Thomas A. Dickinson, an officer of the Natural history society, and were pronounced by Mr. J. A. Allen, of the Museum of comparative zoölogy, to be those of a mastodon about two-thirds grown. An account of the discovery was written soon after by Mr. Franklin P. Rice of Worcester, and printed by the natural history society. A figure of one of the teeth is given.

Early in the present month, arrangements were made with Mr. Maynard by members of the two societies named, acting under the direction of Dr. W. H. Raymenton, president of the natural history society, to make further excavations in the peat bog for the purpose of finding the rest of the bones of the mastodon. While digging eighteen feet to the southwest from the spot where the mastodon skull was found the preceding season, the workmen exposed the top of a human skull, which was at once taken up by Dr. Raymenton, who was superintending the work; and he states that the skull, which he worked out of the enclosing peaty matrix with his fingers, was resting on its basal portion directly on the blue clay and stones. The under jaw was found, teeth downward, about eight inches to the south of the skull, and in immediate contact with the clay. The evidence of several witnesses is conclusive on these points.

Dr. Raymenton and Mr. Dickinson immediately informed me by letter of the discovery; but, owing

to my absence from home, I was unable to visit the place until Oct. 17, four days after the skull had been found. During this visit, I made a careful study of the peat formation and the underlying blue clay, which I take to be the bowlder clay covering the bottom of the basin or old pond, which is some four or five acres in area. Over this blue clay, containing both rounded and split stones, the deposit of peat has taken place. The two skulls, mastodon and human, were unquestionably at the bottom of this peat, both resting on the blue clay; but, owing to the inclination of the basin toward the northeast from the spot where the human skull was found, there were two feet less of peat over the skull than there were over the mastodon. The stratification of the peat was quite marked, and the lower portion immediately covering the two skulls is very fine, and evidently a deposit made entirely under water. Above this the peat is slightly coarser, which character increases to the surface. While a few small pieces of wood were found at the bottom of the peat, several large logs, and what seems to be the remains of a partially burnt stump, were found in the layer about two feet above the human skull. To this depth heavy objects could have readily sunk through the coarse or more open formation above, but I question the possibility of so light an object as a human skull sinking through the lower two feet to the hard pan at any time subsequent to the formation of that stratum. That both skulls were transported, seems to be proved by the fact that no other bones of the two skeletons were found in the immediate vicinity; and that they were transported by water before the peat deposit began, seems probable. The broken portions of the human skull have the appearance of having been worn by water action, and the dissociation of the jaw and cranium would also indicate that method of removal from the rest of the skeleton. Had it been a settling of a heavy body through the peat, we could hardly expect that the skull and jaw alone would have settled to hard pan, and the rest of the bones of the skeleton to have been nowhere near them; and the same remark would apply to the skull of the mastodon.

The skull has been placed in my hands for careful study and comparison, and I hope soon to be able to give definite information in regard to it. Unfortunately, the skull is not a typical one, and the averaging and careful balancing of its characters will have to be made before its race affinities can be determined. In regard to its color, I may add that it is as deep, if not deeper brown, than the bones of the mastodon. Its comparatively perfect preservation when compared with the mastodon skull is, however, remarkable; but this could be easily accounted for by the longer exposure of the mastodon bones on the surface of a gravel deposit before being washed into the basin.

F. W. Putnam.

THE INTERNATIONAL GEOLOGICAL CONGRESS AT BERLIN.

The third and most important session of the International geological congress, which was instituted by an American committee of the American association at its Buffalo meeting in 1876, has just been held.

The first session at Paris in 1878 was really a *pour parler* which broke ground. The next session at Bologna in 1881 accomplished something, but was especially useful in preparing for the work of the session just closed by deciding to produce a geological map of Europe on a scale of 1: 1,500,000 and intrusting its execution to one committee, while another was appointed to devise some scheme for unifying the nomenclature, and, where possible, of fixing the limits of various congeries of beds, which had heretofore been differently understood by different geologists. The obstacles which faced these committees will be at once understood from this bare statement, and will modify any hasty impression that in fact very little has been accomplished.

The two committees, or a majority of members of each, met at Foix and at Zurich during the four years which intervened between the congresses of Bologna and Berlin, and the action of the congress which has just ended was almost exclusively confined to the propositions made in the printed reports of these committees.

Those who arrived in Berlin some days before the opening of the congress found at the superb Bergakademie on the Invaliden strasse the bureau organized to examine the credentials of delegates, and provide each with the necessary card and receipt for the ten marks he paid, besides a medal in silver, bearing the inscription on one side, 'Geologorum conventus, mente et malleo,' with the conventional mallet and chisel crossed, and surrounded by a wreath of oak. On the other side, within a similar wreath, were the words, 'Berlin, 1885.' The medal was suspended by a white satin ribbon, and worn on the lapel of the coat for identification on excursions, etc.

A programme of the order of events may be thus condensed: Monday, September 28, at 10 A.M., meeting of the council at the Reichstagsgebäude; 5 P.M., social re-union of the members of the congress in the ante-chamber of the palace. Tuesday, September 29, 9 A.M., opening of the congress; 2 P.M., visit to the Bergakademie to see

the collections and the objects sent to the congress. Wednesday, Thursday, Friday, and Saturday, sitting of the congress at 2 P.M.; 7 P.M., Saturday, close of the congress. Sunday, 9 A.M., excursion to Potsdam. Then followed announcements of the excursions to the Hartz, to Stassfurt, etc. This programme was followed in the main, only an extra session of the congress being intercalated. The usual course was to devote two hours to the discussion of the committees' reports (2 to 4 P.M.), and the last two hours (4 to 6 P.M.) to scientific discourses of various delegates.

The weather during the entire week was very disagreeable, cold and rainy. On Sunday morning, after the close of the congress, it promised to be fair, but only to deceive the hopes of those who took part in the Potsdam excursion. The commencement of the trip was very beautiful, but towards the close it degenerated into a procession of dripping and shivering people, who tried to look as if it were pleasant in order not to offend their kind hosts.

The language of the congress had been decided upon as French; and this, no doubt, accounts for the greater share taken by the Swiss, Belgians, and French in the debates, than by the people of other nationalities. The Germans, for instance, who outnumbered all other nationalities taken together, had only one representative, who managed the language with fluency, and led in debate, —Hauchecorne, the active spirit of the congress. It is true that Neumayr (an Austrian) did retort very effectively once to M. Lapparent, and his Excellency v. Dechen spoke frequently, if not easily; but Dr. Beyrich, the nominal president, was entirely unintelligible, and Stur was obliged to get a dispensation from the congress and speak in German.

On Tuesday evening at 6 P.M. the first report was given by M. Renevier of Switzerland, the secretary of the committee appointed to prepare the European map, which was thus constituted: Beyrich and Hauchecorne (forming the sub-committee of direction in Berlin), Germany; Daubrée, France; Giordano, Italy; de Moeller, Russia; Mojsisovics, Austria-Hungary; Topley, Great-Britain; Renevier (secretary general), Switzerland. The committee of direction had made an arrangement with D. Reimer & Co., of Berlin, according to which this firm agreed to undertake the publication of the map at its own risk, provided the committee would guarantee them an edition of 900 copies, at 100 francs a copy, and would give them sums on account in advance.

The map is to consist of 49 sheets, 7 in breadth and 7 in height. Each of these sheets is 48x53 cm., and the whole of them together will form a chart 3.36 metres high and 3.72 metres broad. Prof. Kiepert of Berlin is to prepare the topographic base, using for this purpose all data at his disposition, both published and unpublished. Great Britain, France, Spain, Italy, Austro-Hungary, Germany, Scandinavia, and Russia, each takes 100 copies. The remaining 100 copies are to be divided between the six smaller states, Belgium, Holland, Denmark, Switzerland, Portugal, and Roumania. The central committee is to receive from each national committee the map of its country, and to make them harmonize.

The report ended with the following six resolutions, which the committee asked the congress to pass:—

1°. M. Karpinski will succeed M. de Moeller (resigned) in representing Russia on the committee.

2°. The carbonic system (or Permo-carboniferous) shall be represented on the map by three distinct shades of gray.

3°. Brown shades will be applied to the 'Devonic.'

4°. The color to represent the 'Siluric' is left to the discretion of the committee.

5°. The eruptive rocks shall be represented by seven tints, ranging from bright red to dark brownish red.

6°. The determination of the other questions mentioned in the report shall be left to the discretion of the committee.[1]

Proposition 1° was adopted without dissent. Proposition 2°, after much opposition, was agreed to, with the understanding that the proposed method of the committee should not be understood to have any bearing on the scientific settlement of the question, but should be regarded purely as a provisional expedient adopted in order to complete the map. Proposition 3° was agreed to. Proposition 4°, after strong opposition from Prof. Hughes and M. Jacquot, was finally so modified as to allow the committee to adopt it provisionally for the purposes of the map, without prejudging the abstract scientific question at all, and thus carried. Propositions 5° and 6° were carried without objection.

Sept. 30, at 2.30 P.M., the congress re-assembled to take action on the report of the committee on the unification of nomenclature, which was then presented by M. Dewalque. This report had been in the main adopted at the Bologna congress, a few minor

[1] The questions here referred to comprise several matters about which the committee was in doubt: e.g., (*a*) How are the terranes to be represented, of which the subdivisions were doubtful? (*b*) How are those subdivisions to be indicated which are too small to appear on the scale of 1:1,500,000 adopted for the map? (*c*) How are measures to be represented when even their age is doubtful? (*d*) How represent subdivisions concerning the affiliations of which geologists differ (Gault, Rhetic, etc.)?

points having been left for future adjustment. They concerned, for the most part, definitions of terms, such as 'group,' which it was determined should be applied to the divisions of the highest order (secondary group, etc.); the next division should be 'systems' (Devonian system, etc.); the third should be 'series' (coal-measures series of the carboniferous system); the fourth division should be 'stages' (*étages*) (millstone grit, etc.); the division of the fifth order was decided upon (for French only) as 'assise' or 'couches;' 'zone' should be used for a number of beds having one or more fossils to characterize them, but it should be inferior to 'stage' as a term of classification. 'Bank' was selected to imply a bed (*couche* or *assise*) thicker or more coherent than those in its vicinity, among which it is intercalated. These, and certain conclusions as to the application of the terminations 'ary', 'ic', and 'ian,'—the first for the groups, the second for the series, and the third for the stages,— completed the linguistic portion of the report. No termination for systems was proposed.

It was decided to give to the pre-palæozoic rocks the name 'archæan' instead of 'primitive,' and, while recognizing three divisions of them, to allow each geologist to distinguish these by petrographic characters.

On the motion of Prof. Archibald Geikie, the decision as to the limits of the Silurian and Cambrian is left till the meeting of the congress in London in 1888, but the committee on the chart has liberty to divide the lower system of the palæozoic group into three parts, of which the names shall be determined upon later.

After a long and exciting discussion, the propositions were accepted: (*a*) that the Devonian should be divided into three parts, corresponding respectively with those termed the Rhenan, the Eifelian, and the Famennian; (*b*) that the calceola beds should form part of the Eifelian; (*c*) "that the upper limit of the Devonian should be drawn at the base of the carboniferous limestone, that is to say, the system which includes the Psammites of Coudroz, and the upper Old Red." [The words "the lower carboniferous (Kilborkan, Marwood, Pilton)," and "or the calciferous sandstone Dura, Den," were stricken out of the committee's resolution, at the request of Prof. A. Geikie, as not representing the real association of these beds.] The whole paragraph (*c*) was afterward suppressed.

The question of associating the Permian with the carboniferous provoked the most interesting discussion of the congress. Stur of Vienna, Lapparent, Blanford, and Prof. Newberry, spoke in favor of such union. Hughes, Topley, Nikitin, and a great many others spoke against it. Prof. Newberry, in the course of his remarks, said that "his honored colleague, Prof. Hall, was of the opinion that the Permian did not exist in America, and that his own studies confirmed this view."

M. Neumayr thought "the decision of such questions as this should not depend upon a majority vote which would change in each country, and after each eloquent speaker" (referring to Mr. Lapparent's brilliant defence of the committee's proposition). This view was finally taken, and the congress adopted, with about fifteen dissenting votes, the following proposition formulated by Mr. Dewalque:—

"The congress, not wishing to pronounce an opinion on the scientific question, will leave the classification as it is."

After much debate, the threefold division of the triassic was agreed to, but without assigning any names. The division of the system into three was adopted, but without specifying the names of the divisions. It was agreed that each geologist might draw the upper horizon of the lias where he thought best. It was agreed that the 'Gault' should be joined to the cretaceous. The divergence of views on this subject was so great that M. Capellini, then in the chair, cut short the whole question by asking for a vote of confidence in the committee, which was unanimously given.

Finally the sevenfold division of the eruptive rocks in as many tints of red was carried without opposition.

This completed the serious geological work of the congress, and it was then agreed to meet in London in 1888. A committee, consisting of Hughes, Geikie, Blanford, and Topley, was appointed to make the necessary arrangements, and the congress adjourned.

During the course of the congress, addresses were given by Messrs. Gaudry on certain reptiles; Newberry, on a new large Devonian fish from America; Posepny, on the fluid condition of the earth's interior; Ochsenius (in German), on the origin of salt deposits; Neumayr, on the plan for the 'Nomenclator palæontologicus' which he is compiling (and which the congress voted to publish under its auspices, and through the agency of a special committee consisting of MM. Gaudry, Zittel, and Neumayr, and one other whose name escaped the writer). M. Nikitin presented his map of middle and south-eastern Russia, including the valley of the Volga; M. Vasseur exhibited 13 sheets of the map of France; and Dr. Frazer (on behalf of Mr. McGee) presented an explanation of the methods employed by the director of the U. S. geological survey.

The delegation which represented the United States at the congress consisted of Prof. James

Hall and Prof. J. S. Newberry, members of the original committee which suggested the congress; Prof. H. S. Williams, and Prof. Persifor Frazer, who were elected by the American association for the advancement of science at its Ann Arbor meeting. These four constituted the American committee selected by the A. A. A. S. Besides these, Prof. Brush was elected by this committee under the powers vested in it. Mr. J. F. Kemp (asst. to Prof. Newberry), Mr. H. B. Patton (student), and Mr. H. E. Miller (chemist), from America, also appeared on the roll of the congress. Mr. McGee, representing Major Powell and the U. S. geological survey, arrived after the session had commenced.

In all, 255 members were in attendance, of which 163 were from Germany, and the rest mainly divided between Italy (18), Austria-Hungary (16), Great Britain (11), France (10), United States (9), and Belgium and Russia (6 each).

A detailed report of the committee, giving the debates in part, has already been completed.

LOCALIZATION OF FUNCTIONS IN THE BRAIN.

HAPPY those who in the rapid revolutionizing of brain-physiology, which the last few years have brought about, have kept abreast of the current. For the new publications are so minute and rapid that, once left behind, there is no hope of catching up. The vivisectional results of Goltz, Ferrier, Munk, Luciani, and a host of others, with the rather rough polemics which have characterized the German writings on the subject, must have given to many the impression of an almost desperate field where no two experimenters could agree as to the facts, and no one, not himself an experimenter, could critically judge of the relative merits of the investigations published. The researches of Munk in particular, professor at the veterinary school in Berlin, seemed to be on such a vast scale, had such an imposing clearness, were set forth with such an air of *überlegenheit* over all comers, and above all presented such an exact correspondence of facts with theoretical requirements, that it was hard to know just what to think of them. Everyone's else researches sounded clumsy and immature in comparison. And yet their very absoluteness awakened suspicion. Munk seemed too clever, his neatness more French than German. Nature does not often yield so exactly balanced a sheet of accounts with our laboratories, especially those of physiology. Results are apt to be more conflicting, and vary more from one *versuchsthier* to another. And so in spite of Munk's apparent superiority, many lookers-on have secretly felt as if the ruder style of Goltz and others, and their vaguer conclusions, would prove to be more in the line of final truth.

Professor Christiani's little book strongly helps to corroborate this view. Munk is a strict localizer of functions. By his extirpations in dog's brains he thought he had mapped out the exact part of each occipital lobe which presides over the sensibility of each part of the retinal surface. He said that blindness, sensorial and intellectual, total and irreparable, follows complete ablation of these lobes; and when Herr Christiani in one of the memoirs republished in this volume, announced his observation that rabbits from which the cerebral hemispheres were entirely removed, would, nevertheless, steer clear of obstacles in their path as they loped about the room, Munk came down upon him with a tone so much resembling divine retribution that all bystanders must have thought it impossible for the younger investigator ever to show his face again. But this was reckoning without the resources of experimental physiology. Professor Christiani comes up smiling in the pages before us, and, we think, shows himself decidedly the better man of the two. Not only does it appear from Munk's subsequent confession that his first would-be repetitions of Christiani's experiments on rabbits were injudiciously performed, but we think we also see a decided obstinacy and lack of candor in Herr Munk's refusal to admit the injudiciousness. As well as a mere reader can judge, Christiani seems to have really proved that the avoidance of obstacles during locomotion is in rabbits a function which may be performed by the aid of visual centres *below* the hemispheres of the brain; in other words, that his rabbits were not really blind.

The latter half of the book is occupied by an historical survey of the localization of the function of vision, a survey of which the evident purpose is to show by a cumulation of evidence, how one-sided Herr Munk's observations, and how absolute his inferences, have been. This survey is to be recommended to all who would like to review this interesting chapter of physiology. It leaves naught to be desired in the way of learning, and its polemic tone is courteous. It shows an amount of evidence against any *exclusive* connection of vision with the occipital lobes, which, to our mind, is quite overwhelming when brought together in this way. It suggests, as Goltz does, that much of the blindness resulting from lesion of the occipital lobes may be due to an *interference* with lower visual centres spreading from the irritation of the wound. But, though breaking down

Zur physiologie des gehirns. By ARTHUR CHRISTIANI. Berlin, *Enslin*, 1885. 10+175 p., 2 pl. 8°.

the absolute form of Munk's localizations, Professor Christiani does little to put any other positive and definite conceptions in their place, and one may say as a last result, that he leaves the subject of division of labor in the brain as obscure as he found it. There are some other important and interesting experimental discoveries in the book, to which we lack space for reference. It may be added, in a general way, that the question of localization seems now in a far more hopeful state than ever before. The distinction of relative centres and absolute centres, introduced by Exner, in his statistical study of human brain lesions, bids fair to be a fruitful conception, if it can ever be intelligently worked out. A recent article by Exner in the *Biologisches centralblatt* (band v., hefte 1 und 2), takes a mediating position and tries to show that the facts reported by Goltz and Munk are far less at variance than the reporters themselves think. It is a very praiseworthy article, and should be read by all those who are interested in the subject of Professor Christiani's work.

GEOGRAPHICAL NOTES.

ADVICES from the Pacific coast afford some details in regard to the journey of Lieut. H. T. Allen and his companions, though the complete report is of course reserved for headquarters. There is a good deal of confusion of names, distances, and positions in the press reports, from which, however, we are able to gather that the party ascended the Copper or Atna River, and explored its northern and western branch to its source, a distance which, omitting irregularities of the stream, must be between two and three hundred miles. The Copper River had been explored by Serebrannikoff to a distance of some fifty miles from the mouth in 1848; and several prospectors have been on the river since the purchase of the territory by the United States, but no record, except in newspaper articles, has been kept of their wanderings. The branch explored by Lieutenant Allen and the eastern branch are about of equal size; the latter is believed to rise not far from the head of Lynn Canal. They found the river extremely rapid, with many cataracts, and having in some places a fall of seven feet to the mile. Its width is variable, sometimes several miles, including large islands; at others but a few hundred feet. There are many glaciers near it, and the active Wrangell volcano rises almost from the river. Remains of the mammoth were seen; the color of gold was found in the river-bed, and copper and silver ore brought back, the former from the range in which the river heads. A portage was made across this range to the sources of the Tananah, where there are a number of extensive lakes. The river was reached about 125 miles above the point to which it had been explored, and it and the Yukon were followed to the sea. Game was not very abundant, fish being the chief reliance of the Indians. No casualties occurred, the chief difficulty being to obtain labor, since the Indians were averse to work. Two miners and several Indians were with Lieutenant Allen's party, which found some difficulty in subsisting on the country. Great credit is due Lieutenant Allen and his companions, whose journey may be compared to that in which the celebrated Robert Campbell discovered the sources of the Yukon.

Lieutenant Cantwell's recent exploration of the Kowak River was made by a party consisting, beside the commander, of two seamen; C. H. Townsend, naturalist; an interpreter; and eight or ten Innuit. The river was entered July 2 with a steam launch and two canoes. At the rapids Townsend remained with the launch, the rest ascending in skin canoes. They reached with great difficulty a cañon some 300 feet deep and very narrow. The boats were hauled over a temporary bridge constructed of felled trees. Above the gorge the stream became very shallow. After great difficulty the source of the river was reached, consisting of four large lakes, of which the most important is in about north lat. 67°, west long. 153°. It is supposed to be about 520 miles from the mouth of the river.

Assistant engineer Samuel B. McLenegan, who accompanied Cantwell in his exploration of the Kowak in 1884, this year undertook a very difficult bit of exploration in a double bidarka or kayak, obtained at Unalashka. Owing to the difficulty of obtaining native assistance he was accompanied only by Seaman Nelson of the Corwin. They ascended the Noătak, also called the Nunatak or Inland River, which has been known for thirty years, but never explored. This river enters Hotham Inlet, westward from the Kowak, and about thirty miles north of the arctic circle. They entered the river July 2, and found almost from the first great difficulty in stemming the rapid current; at times they were compelled to track the canoe by a line from the bank, or wade in the shallows of the river-bed. Much of the region was mountainous. The river passed through numerous cañons, with sides rising high above the water, even reaching 1,000 feet in some places. The scenery was very grand. Indications of iron and copper ore were observed in many places. Two hundred and seventy-five miles, by the river, above its mouth, part of the provisions were cached, and the explorers lived on the country,

finding game plentiful. On the 30th of July a point was reached where canoe navigation ceased on account of shoal water, and the two men proceeded on foot. Near the head-waters, instead of mountains, there were elevated moorlands, with scanty vegetation and destitute of timber. The source of the branch ascended was found to be a small lake surrounded by snow-banks, and supposed to be about 400 miles from the coast. The natives, of whom about 250 live on the river, were friendly, and the return voyage was made without accident. The run down the river was very exciting owing to the numerous rapids and impediments. The party reported on board the Corwin August 27. The voyage, which was extremely creditable to those who took part in it, is noteworthy, as the party reached the highest latitude yet attained by white men in the interior of this part of Alaska. The report and charts which are being prepared for the department will doubtless fill a large part of the blank space which occupies the best maps of this area.

A letter from Mr. Henry D. Woolfe, who has been during the past year stationed at Cape Lisburne on the arctic coast north of Bering Strait, states that the winter there had been a mild one, February being the coldest month, with a minimum for the winter of — 45° F. There were many heavy southerly gales during December, January, and February. The range of hills in which the Noätak or Nunatak River rises was in a direction E. N. E. mag. only three days from the station. In February and March he travelled along the coast from Cape Lisburne to Hotham Inlet, and ascended the Noätak on the ice about thirty miles to a village of Innuit. Between the Corwin Lagoon and Cape Krusenstern a river falls into the sea, which he was informed was connected with the Noätak, running behind the hills which lie back of Shesholik village. Mr. Woolfe is preparing a map showing all the native settlements and even single huts temporarily occupied along the coast between Cape Krusenstern and Point Barrow. He had discovered several new coal veins, and, in fact, found a region about twenty miles square that was a continuous coal-field, the coal belonging geologically to the carboniferous age, and being easily got at, and of excellent quality. It has long been used for fuel by the whalers, and the Pacific whaling company are having it mined to supply their steam whaling vessels.

ASTRONOMICAL NOTES.

Small versus large telescopes.—Mr. Denning's crusade in favor of small telescopes seems to have come to a rather inglorious ending in the closing sentence of his letter (*Observ.*, '85, 305), which reads, "The efficacy of small instruments comes in where it is desirable to have that critical sharpness of the image resulting from a suitable blending of aperture and power with atmospheric conditions," whatever that may mean. The truth would seem to be, that very much of what observers with small telescopes call 'sharp definition' is merely the smoothing out of actual minute irregularities, or very slight unsteadiness, which limited aperture is powerless to separate or define, on account of the overlapping diffraction circles or bands, which necessarily constitute the image of every point or line. One matter, however, might with profit be further investigated, and that is, whether the larger cylinder and cone of rays from a large aperture materially increase the disturbance of the image when the seeing is bad. Perhaps the most amusing feature of the whole discussion is where Mr. Denning (*Observ.*, '85, 207) fails to grasp the sarcasm of Professor Hall's communication (*Observ.*, '85, 174), and takes it as written in sober earnest.

Comet 1885. III. (Brooks).—The comet found by Brooks on August 31 appears to have passed perihelion about three weeks before discovery. According to three independent sets of elements, perihelion passage occurred on August 10, the comet being then at a distance 0.75 from the sun (the earth's distance from the sun being unity). The nearest approach to the earth seems to have occurred about September 25. Even at its best, the comet seems to have been a very unsatisfactory object to the observer; and it can probably be seen now only in the more powerful telescopes. It is less than a third as bright as on September 5. The observations thus far published extend to about the middle of September, and the comet is generally described as round, faint, increasing a little in brightness toward the centre, without definite nucleus or tail, and some two or three minutes of arc in diameter. We should mention that Mr. A. A. Common, of Ealing, England, is reported to have discovered the comet independently on the evening of September 4.

New variable in Cygnus.—Mr. J. E. Gore announces (*Astr. nachr.*, 2683) that the red star Birmingham 587, south-following ρ Cygni, varies between 5.8 and 7.5 magnitudes, in a period of about 250 or 300 days, the last maximum having been in December, 1884. The star is Lal. 42153 and D.M. + 44°, 3877.

Common decimal unit of circular measure.—It seems that the recent somewhat sensational announcement (*Nature*, xxxii. 465) of a supposed rapid proper motion in Nova Andromedæ arose from the failure of an English amateur to distin-

guish between seconds of arc and of time. Although an inexcusable blunder, yet it serves to emphasize anew the intolerable nuisance of this double unit, and makes us wish for the speedy coming of the day when all kinds of circular measure shall have a common convenient unit; when every watch and clock face, every graduated circle, and every logarithm-table of the trigonometric functions, shall be divided into decimals of the circumference.

Gould's Zone catalogue.—The Argentine government have presented the stereotype plates of this valuable catalogue to the Astronomische gesellschaft, with authority to use them for a new edition whenever it is needed.

NOTES AND NEWS.

THE National academy of sciences will hold its autumn session in the capitol at Albany, beginning November 10, at eleven o'clock. The session will probably continue three or four days.

— The Lowell free courses in the Teachers' school of science, under the auspices of the Boston society of natural history, will begin on November 7, with a series of lectures by Prof. A. Hyatt on the structure and habits of typical animals.

— Despatches from Paris, under date of Oct. 27, announce that at the meeting of the Academy of sciences, held that day, M. Pasteur furnished proof of his theory that inoculation was easily practicable, and had been successful in preventing hydrophobia. Dr. Vulpian gave additional proofs confirming the deductions of M. Pasteur.

— Mr. F. W. Putnam has been chosen Peabody professor of American archæology and ethnology under the Peabody trust at Harvard university.

— The October number of the Harvard university bulletin contains continuations of the very useful index to the maps in the London geographical society's publications, and a further instalment of the bibliography of the Kohl collection of early American maps.

— *Lippincott's magazine* for November contains a well-written article on the Peabody museum of archæology at Cambridge, by Ernest Ingersoll.

— Henshaw's list of the Coleoptera of America north of Mexico, just issued, includes 9,238 species. Crotch's check-list, published in 1874, contained 7,450 species. Previous to these came the lists published by Le Conte, and in 1880 Austin published a supplement to Crotch, bringing the number of nominal species up to 9,704, which recent studies have greatly reduced.

— The Johns Hopkins university *circular* for October is entirely devoted to the summer work of the Chesapeake zoölogical laboratory at Beaufort, N. C., and contains interesting summaries of investigations upon the embryology of a variety of invertebrate marine animals, and on the physiology of some of the lower vertebrates. An interesting 'Note on inheritance,' by the director, Dr. Brooks, is added, containing a rejoinder to some criticisms that have appeared on the author's work on 'Heredity,' together with a short letter from Fritz Müller, discussing the question of heredity among the Brazilian species of Melipona.

LONDON LETTER.

THE prospects of the Marine biological association are now beginning to shape themselves somewhat definitely. A suitable site for a laboratory has been obtained at Plymouth, and the building committee, which consists of the officers, together with Mr. John Evans and Mr. Spence Bate, will meet shortly to make a final decision upon the plans which they will recommend to the council. The subscription list has not received many additions of late; but it is hoped that further contributions may be obtained, when the public can form a better idea of the nature of the building and its uses than is the case at present. A grant of money will probably be given by the treasury toward the expenses of the station, provided that it is brought into relation with the Scotch fisheries board, the duties of the English fish inspectors being limited to the salmon fishery only.

A considerable amount of criticism has been excited in biological circles by the action of the government in abolishing the professorship of natural history at the Normal school of science, South Kensington. The chair has hitherto been filled by Professor Huxley, who has lately retired in consequence of ill health; and as the salary attached to it is greater than that of any similar post in England, it has always been regarded by the younger school of zoölogists as the highest object of their ambition. Now, however, this will be no longer possible. English zoölogical teachers are left without an official head, and the flow of promotion has received a sudden check. It had been generally thought that the chair would be given to Professor E. Ray Lankester, who is well known not only as a distinguished investigator, but also as a teacher of no ordinary power. His claims, however, have been altogether passed over. The professorship has been abolished, and a

lectureship, at a diminished salary, has been established in its place. This is filled by Professor Huxley's former assistant, who has long had entire charge of the laboratory teaching, and has just brought out an admirable atlas of elementary biology. It was certainly desirable that his merits should receive the recognition which they deserved. But this might surely have been effected without the infliction of a blow which will be felt in almost every zoölogical laboratory in the country.

The Prince of Wales has fixed Monday, November 9, for the official closing of the International inventions exhibition. Upwards of three and a quarter million visitors have thus far been admitted. A valuable series of reports, by experts, on the various classes of exhibits, is appearing in the *Journal of the Society of arts*, which has been from their commencement, the official record of these exhibitions. A scheme is on foot for forming, from this exhibition, a floating exhibition on board a large steamer, which is to visit the chief ports; and in this way the benefits of the exhibition may be extended.

Among the various agencies for creating an interest in the methods and results of scientific inquiry, on the part of artisans and persons of very limited means, the operations of the Gilchrist educational trust deserve notice. The founder, Dr. Gilchrist, a Scotch surgeon, left on an exceedingly open trust, for the benefit and advancement of scientific learning in any part of the world, the income of certain investments, which have since become very valuable. One of these was a piece of land now in Sydney, Australia, for which he paid $90, which was sold a few years ago by the trustees for $360,000. Part of the trust income is expended in scholarships, chiefly granted to students in Canada, Australia, India, etc., to enable them to study in England. Another portion is devoted to the delivery of courses of scientific lectures in English and Scotch towns, under local management, but subject to the condition that the charge for admission shall not exceed two cents. These lectures are specially addressed to large popular audiences, often comprising 2,000 persons or more. Ten such courses are now running in various towns, and the lecturers engaged in them are Dr. R. S. Ball (Royal astronomer for Ireland), Dr. Dallinger, Prof. W. C. Williamson, Dr. Andrew Wilson, and Mr. Wm. Lant Carpenter. A course usually consists of six lectures, one half on physical subjects, the other upon biological, and their aim is avowedly to awaken an interest in science. Usually the lecture halls are crowded to their utmost capacity. W.

London, October 13.

WASHINGTON LETTER.

THE improvements on the arrangement for protecting the Washington monument from damage by lightning are now being made, and will probably be completed within a week. The disturbed portion of stone-work has been very neatly drawn back into its place, and secured by bolts from within. The changes which are being made, with the hope of avoiding all possible injury in the future, are essentially as follows: Around the lower part of the aluminium pyramid which terminates the shaft has been fitted a sort of collar, from which project eight pointed metallic rods, each about three inches in length. To the corners of this collar four copper rods, about one-half an inch in diameter, are secured, extending down the edges of the fifty-five-foot pyramidal apex. These four rods are joined together at a number of points along their length by horizontal strips of metal, each having a cross-scction area nearly as great as that of the half-inch rod, but of different form, so as to fit closely into openings along the junctions of the various layers of masonry. All are securely joined to the corner or edge rods; and along both horizontal and edge rods metallic points, similar to those surrounding the base of the aluminium apex, will project at right angles to the rods, and at distances of four or five feet from each other. It will be seen that the great terminal pyramid will thus be covered with a sort of cage of metal rods, from which will project a large number of small metallic points. All of the metal thus placed upon the surface has been carefully plated with gold to prevent discoloration of the stone through the action of the weather on the copper.

The connection of this external cage with the internal conductor seems to be all that could be desired. To begin with, from the base of the small aluminium pyramid a copper rod or bolt, one and a half inches in diameter, extends to the base of the capstone, by means of which it is secured to the latter. From the extremity of this rod four rods of copper, each having a diameter of three-fourths of an inch, proceed downward, and, separating at a distance of a few feet from their upper ends, are led to the four middle piers of the iron structure which carries the elevator and the stairway. This structure extends through the whole height of the monument up to some distance beyond the five-hundred-foot level. It consists, in the main, of eight wrought-iron columns, four being six and one-half inches in diameter, and four seven and one-half, and all tied together through iron braces and stays. In addition to the electrical connection of the exterior cage through the aluminium apex, as above described, independent

connections of the corner or edge rods to the iron columns are made at several points lower down, by passing one-half and three-quarter inch copper rods through holes drilled in the stone-work of the pyramid. At the bottom the earth connection is made by four heavy copper rods, which project several feet into a well of moist sand, at the bottom of which water is always standing.

Owing to the unrivalled height of this monument, its protection from damage by lightning is a matter of scientific as well as of practical interest, and the efficiency of the plan now being carried out will doubtless be questioned in some quarters; but it is a problem which time alone can satisfactorily solve. Z.

Washington, D.C., Oct. 26.

BOSTON LETTER.

ALTHOUGH the removal of *Science* to New York is greatly regretted here, the many friends it has made in the place of its birth continue to express their great interest in its success, and their appreciation of the efforts made toward its constant improvement. Its weekly reception, too, on the very day of its publication in New York, makes a very favorable impression, since this was by no means the case when printed here; it lessens, to some degree, the regret at losing it as one of the scientific attractions of the community.

The publication of the 'Life of Agassiz' is most favorably commented on in our scientific circles. It awakens anew the enthusiasm toward our great naturalist which was always manifested in the most lively manner whenever he made a public appearance. We are all glad, moreover, to possess a clearer and fuller account of his university life, when he was laying the foundation of his remarkable career. The unity of his whole life, the persistency of his mental and moral characteristics, can here be traced as never before, while the successful outcome of his early aspirations lend a completeness to the picture, and are a source of inspiration to any reader.

No clearer case can be pointed out than his connection with Harvard, of the utmost importance to a university of securing men in its scientific posts who are not merely excellent teachers, but are also thorough and active investigators, imparting to their pupils their own ardor in scientific research. The band of students who flocked to his standard is scattered all over the country, most of them teachers in colleges, and everywhere leaders in scientific work and thought. No other such band of disciples in any science has ever appeared in our country; and his presence at Harvard raised the standard of its scientific department to a height of excellence and renown, as nothing else could have done.

It may not be known to all your readers that the designer of the Puritan has made his mark already in quite another field of science, being favorably known for many years as an entomologist. His memoirs on the anatomy of Lepidoptera and other orders of insects, and his minute technical knowledge of Diptera, easily won for him a place in our Academy of sciences. His friends in the scientific club here are very enthusiastic over his new success, and propose to give him a dinner in recognition of their appreciation of it, at which it is hoped that he will relate some of the points which have made the Puritan the fastest known yacht in the world. Yet they have some doubt whether he will consent even to this private honor; for, though the most genial companion in the world, Mr. Burgess is modest to a fault.

The bequest of the late Robert Treat Paine was mentioned in *Science* last July, when it was stated that Harvard college observatory would receive nearly three hundred thousand dollars, one half at once, the other on the death of his widow. This was particularly opportune, for the increased work of the observatory in later years had been due to an annual subscription raised by its friends for a limited period, then recently past. Unfortunately, it now transpires that the will is contested in the courts by the heirs-at-law, who claim that he "was not of sound and disposing mind and memory." Under the laws of Massachusetts, the costs of legal action of this sort are chargeable to the estate, so that there is danger that, even if the will is not broken, the amount finally received by the observatory may be somewhat diminished, and, in any event, delay must ensue; so that the observatory is now working on a sadly diminished income, for which even the zeal and ingenuity of the indefatigable director cannot wholly atone. Y.

Boston, Oct. 24.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Cruise of the Arethusa.

THE yacht Arethusa, having on board an expedition to Newfoundland, previously noticed in *Science*, returned September first to Annisquam, Mass., after a successful trip of three months.

The scientific party consisted of Prof. Alpheus Hyatt, curator Boston society natural history; Dr. E. G. Gardiner and Mr. George Barton, instructors in the Massachusetts institute of technology; Dr. Howard M. Buck, of Boston; Sidney R. Bartlett and C. L. Burlingham, students of the Institute of technology.

The weather while going and returning was not upon the whole favorable, but while on the coast of Newfoundland and Labrador, from June 17 to about

August 10, it was very fine, and greatly facilitated the work of the shore parties. The prevalence of high winds made opportunities for dredging exceptionally rare, and very little was accomplished in this direction. The shores proved, also, excessively barren; the pools were infrequent and not rich in species. From Cape Ray to St. John's Island, for the space of two hundred and fifty miles on the western coast of Newfoundland, the principal mountain ranges, whose general course is north-east-south-west, approach the sea more or less closely. They are so arranged that they present their ends to the sea on the south coast, and are seen more from the side on the west coast. From St. George's Bay to St. John's Island, on the western coast, they form a series of steep cliffs, cones, and domes, which also greatly enhance the beauty of the deep and branching fiords of Bay of Islands and Bonne Bay. The climate, vegetation, and lovely harbors, made the trip along this part of the route a series of delightful surprises.

The only population on the west coast consists of small settlements of fishermen, with very few persons of a higher grade Besides these permanent inhabitants, there are several fishing settlements of French, who come only for the summer. They still have fishing privileges on and off this coast, but are not allowed to erect permanent habitations. These rights and the islands of the St. Pierre group on the south coast, where their flag flies, are the remnants of the once extensive territories of the French nation on this continent.

Hotels, boarding-houses, and travelling accommodations, do not as yet exist. The steamer which runs from St. John's to Bonne Bay is so uncomfortable that only the hardiest males would be repaid for attempting to force a passage even in summer as far as Bonne Bay. The officers of this vessel were exceedingly polite and obliging, but the owners have sadly neglected their duty in all that relates to the steward's department.

Fossils were collected at various localities along the west coast from near Cape St. George to Cape Norman, the northernmost point of Newfoundland, and at the Atlantic entrance of the straits of Belle Isle. These fossils fairly represent the faunas of the formations called Quebec and Point Levis groups by the Canadian survey, and the Trenton and lower carboniferous of the Newfoundland survey.

The facilities for acquiring fine specimens of fossil cephalopods far exceeded the most sanguine anticipations. Several well preserved specimens of the imperfectly-known and curious, primitive form, Piloceras; fragments of orthoceratoids allied to Endoceras, which are more than two feet long and four inches in diameter at the living chambers; a number of large cyrtoceran shells, and a considerable number of more or less perfect, close-coiled and lituites-like Nautiloidea are among the principal acquisitions. The latter include all the species originally described by Billings from Newfoundland, and probably some new species.

It may be provisionally stated that Piloceras is a curved or cyrtoceran form of Endoceras, and that Actinoceras also had a curved shell in some species, which was not less than thirty inches in length.[1]

[1] This is a strong confirmation of the author's views that the same group of Nautiloidea and Ammonoidea may have straight, bent, or cyrtoceran, and even close-coiled shells.—*Science*, Nos. 52-83, 1884, and Proc. Am. assoc. adv. science, vol. 32.

Two fine specimens of the latter with very long, living chambers, were dug out near Point Rich.

The limestones of the Quebec group form a continuous and unbroken series of conformable strata, which are particularly well shown at Port au Port. The large numbers and prevalence of gasteropod shells of the genera Maclurea, Pleurotomaria and Murchisonia, fragments of Isotelus and Asaphus, and the abundance of Endoceras-like orthoceratoids and Actinoceras, together with transversely-ridged species like Orthoceras vertebrale, give the fauna of the uppermost of these limestones at Port au Port a Lower Silurian aspect. These resemblances, however, are counterbalanced by marked differences. Thus there is a comparative scarcity of Brachiopoda, and there are no massive corals which can be considered as having materially aided in the accumulation of the rocks. The presence of ancient forms like Archeocyathus and Calathium, which are probably sponges, and of Piloceras, and the comparative abundance of the coiled forms and partly-coiled Nautiloidea with open umbilici and cylindrical whorls, indicates a primitive assemblage of organisms more ancient than the Lower Silurian, and evidently introductory to that fauna.

At Port au Port, also, the actual contact of the Levis slates with limestones of Quebec was studied. These rocks contain Lingulae in abundance, and also trilobites, already described by Billings. It cannot be questioned that they lie above the limestones and are conformable, though having an entirely distinct fauna.

Above this lies the so-called Sillery conglomerates and sandstones, a series of unfossiliferous strata. As described by Richardson of the Canadian survey, and Murray and Howley of the Newfoundland survey, they are also comformable, but overlie the Levis slates.

A fault, already traced by Murray and Howley, separates the northern horizontal outcrop of the Sillery at Long Point, Port au Port, from Murray and Howley's Trenton limestones.

The fauna of these last is certainly like that of the Trenton of New York, but it has a decidedly Newfoundland facies, and its only visible contact is along the perpendicular fault above mentioned. It contains a great abundance of Bryozoa, Brachiopoda, and reef-building corals, which remind one constantly of the aspect of the Trenton fauna, and has altogether a more modern aspect than the Quebec faunas. It is not yet ascertained whether the Endoceratites found are true Endoceras, but fragments of an undoubted Gonioceras were collected in considerable numbers in the lower series of these rocks. It seems, therefore, very probable that Murray and Howley are correct in considering the strata at the end of Long Point as the equivalents not only of the Trenton proper, but also of the Black River and Bird's Eye faunas.

All of the rocks in this part of the island dip away from the mountains in a south-westerly direction, passing out of sight under the waters of the Gulf of St. Lawrence. Thus the outermost strata are, in a general way, more recent than those lying inland or nearer the mountains. The geological position of the Trenton at the end of Long Point, Port au Port, is not far out to sea, but the well-marked fault which occurs between it and the Sillery to the south, or the same narrow point, shows that it is a fragment of an overlying formation, which, having fallen to its

present level, has been preserved, together with the older rocks immediately adjoining.

The immediate contact of the Quebec limestones and underlying sandstones and quartzites was seen but not closely examined. There can, however, be but little doubt that the quartzites of Bonne Bay, on the east shore of the east arm, lie as described by Richardson and mapped by Murray, directly underneath the Quebec limestones, and are conformable. Whether they are the equivalents of the Potsdam or not, can only be determined from Richardson's observations and collections.

Collections were made at Anse au Loup and Amour Cove in the so-called Potsdam sandstones and limestones of the Canadian survey. The observations made at these points indicate a fauna quite distinct from those of any of the limestones or slates of the west coast of Newfoundland. The absence of Cephalopoda and the prevalence of primitive forms of Archeocyathus show the rocks to be probably older than those of the Quebec group at Port au Choix and other localities. The primitive sponges, or Archeocyathi, have here replaced corals completely, and may be described as reef-builders, since numerous hummocks and masses and parts of the strata are formed entirely of their remains. Immediately below these limestones, and conformably with them, lie the red sandstones, several layers of which are perforated with Scolithus burrows.

The geological evidence brought forward by Sir William Logan in the report of Canadian geological survey, 1863, to prove that the straits of Belle Isle have been partly formed by a synclinal valley, appears to us to be very defective. It is more in accord with the evidence to consider that the whole of northern Newfoundland was once much more elevated, and has been sunk by faulting until at the straits the Quebec has been brought down to the same level as the red sandstones of the opposite Labrador shore. The origin of the straits would in that case be considered as due to the changes of level produced by one or more of the same great series of parallel faults already traced by Richardson, Murray and Howley along the west coast. These run parallel with the axis of the straits, and seem to account fully for all the phenomena.

Observations were made upon the raised beaches and terraces which occur along the shores of Newfoundland and Labrador; and here, as well as at Anticosti and the Mingan islands, the marks of the recent elevation of the land are abundant.

ALPHEUS HYATT.

An archeologist in trouble.

I am writing a book on American archeology, and as I cannot reconcile the accounts that are given of some of the most noted earthworks of the Mississippi valley, I naturally turn to you for help. Thus, for instance, I find that, according to one authority, Cahokia mound covers an area of fifteen acres; another puts it at twelve; whilst a third is content with six. All these gentlemen were practical explorers, and as they took the measurements 'carefully,' some of them even with mathematical instruments, there can, of course, be no mistake in the figures. In regard to the Serpent mound in Adams county, Ohio, there is a similar state of affairs. One practical explorer, who is nothing if not thorough, tells us that it is 1,415 feet long; another says it is 1,116; whilst a third, too wise to commit himself to any precise figures, merely says that, if extended, it would not be less than one thousand. To any but a practical explorer, these discrepancies may seem large, and, no doubt, they will deter a mere historical student from using these figures in any statement that aims at accuracy; but in reality they are not of much importance, since it is possible, by a judicious use of the system of averages, to arrive at conclusions that are certainly as near the truth as are most of the original measurements. One thing, however, does bother me, and that is the 'frog' which a recent explorer has discovered in front of the so-called 'egg' that lies between the serpent's jaws. It is 61 feet long, exclusive of the hind-legs, and is said to be in high relief (three feet); though another practical explorer, who visited the same work at about the same time, saw nothing of a frog, either jumping or sitting still, but does speak of a cow-path which may enclose an area of about that size. Now, Mr. Editor, what am I to do? I cannot go out there myself and 'step off' these distances; and if I did, some long-legged fellow would be sure to come along with *his* pair of mathematical instruments, and prove that my measurements were all wrong. Besides, I don't intend to give up that frog—it adds too much to the picture I am having prepared—and yet, I do not see how I am to average it so as to keep my measurements accurate.

R. R.

The spectrum of γ Cassiopeiæ.

Using a high dispersion, and the same precaution with regard to the eye as described upon a former occasion, in addition to the hydrogen lines, there are seen in the spectrumof γ Cassiopeiæ two lines and a dark space between C and D_3, five bright lines and three dark ones between D_3 and $H\beta$, one bright line between $H\beta$ and $H\gamma$, and perhaps another between $H\gamma$ and $H\delta$, with a dark space near $H\delta$. Changing the scale readings of these lines into wave-lengths, we obtain practically, with one exception, the same values as those of the bright lines observed in a solar protuberance in a total eclipse.

These lines apparently do not necessarily all appear at once, and afford an excellent field for study.

O. T. S.

New Haven, Oct. 21.

The care of pamphlets.

Mr. Goode asks, in *Science* of October 16, for the experience of others in regard to the care of pamphlets in scientific libraries. I give below a quotation from the publications of the Washburn observatory, vol. ii., which describes my plan, which was originally described in the *Library journal* for June, 1880.

"The pamphlets are kept in large drawers immediately below the book-shelves, and a drawer is devoted to a subject. As soon as a pamphlet is received, it is catalogued under its author's name, and placed in the drawer devoted to its subject. All the pamphlets on a given subject can therefore be at once consulted in one place; and all the works of a given author are to be found together in the card catalogue. I have used this plan for keeping pamphlets for [thirteen] years, in my own library, in the library of the U. S. naval observatory, and here, and I consider it to be an entirely satisfactory solution of the

troublesome problem of how to treat pamphlets in professional libraries." EDWARD S. HOLDEN.

Washburn observatory, Oct. 19.

An attempt to photograph the corona.

By a slip of the pen in my communication on this subject in the last number of *Science*, I gave the references to two previous letters as April 29 and April 13. These should read May 29 and May 15. By a typographical error I am made to refer the observations on the light of the corona to Prof. S. P. Langley. The observations were made by his brother, Prof. John W. Langley.

According to his observations, as we have already seen (*Science*, August 14), the light of the corona within 1′ of the sun's disk is six times that of the full moon; which, according to my observations, would be one-fiftieth that of our atmosphere in this vicinity. Professor Bonney states, (The sun, p. 229.) that a brilliancy of only one sixty-fourth would be sufficient to render the planets visible. Therefore, even if the atmospheres of Mercury and Venus produced no visible effect at all, the facts would still sustain Professor Langley's observations.

WM. H. PICKERING.

Recent Proceedings of Societies.

Philosophical society, Washington.

Oct. 24.—Mr. H. A. Hazen read a paper on condensing hygrometers and sling psychrometers. As preliminary to the paper proper, Mr. Hazen gave the results of some interesting experiments which he had made with a view of determining the most desirable distance between the lines upon the stem of a thermometer, in order that tenths of degrees may be estimated with the greatest accuracy. He had made a considerable number of trials, in which he had first estimated the fractions, and afterwards measured them by the use of a vernier. The results seemed to indicate that there was a length of division on which the estimation of tenths might be made with greater precision than on one either longer or shorter. Mr. Hazen did not consider, however, that his experiments were sufficiently numerous to enable him to determine this with certainty. On directly addressing himself to the subject of his paper, he called attention to the various forms of Regnault's condensing hygrometer, which had appeared from time to time, briefly discussing the advantages and disadvantages of each. He spoke of the numerous methods which have been devised for ventilating the psychrometer, and expressed his belief that the form known as the 'sling' was the best of all. Experiments made by using both of these instruments for the purpose of determining the value of the constant A in the common psychrometric formula were described, and the effect of elevation was considered. ——Mr. Mendenhall exhibited one of Sir Wm. Thomson's long-range voltmeters, which had been recently imported by the chief signal officer. A small cylinder of soft iron hangs upon the short arm of an index lever, which is so balanced as to be practically in indifferent equilibrium. The iron is surrounded, without contact, by a coil which is so wound that the strength of the field produced by the passage of a current increases from the lower to the upper end of the coil. As the pull on the soft iron is proportional to rate of the change of the square of the strength of field, and as this rate diminishes from the lower to the upper end of the coil, the force exerted on the cylinder will depend at once on the current strength and on its position in the coil. By hanging a small non-magnetizable weight to the iron by means of a hook projecting from the lower end, this force is made to be constant when equilibrium exists, so that when the current strength varies, the position of the iron cylinder changes, and this position is read off on a scale at the extremity of the long arm of the lever. The great merits of the instrument are its constancy and the ease with which it may be adapted to the measurement of potentials differing greatly in magnitude.— Mr. Mendenhall also made some remarks upon instruments and measurements of the so-called re-action time, originating in the exhibition of these instruments by Dr. Matthews at a previous meeting of the society. He referred to a paper upon the subject, which he had published in the *American journal of science*, in 1871, in which instruments and methods are described identical in many respects with those recently exhibited. Results were given, showing the time occupied in responding to a signal, which was a flash of light, the appearance of a card, a sound, or a blow upon the hand or head, and also the time consumed in the simplest processes of reasoning. These times were, in general, shorter than those recently obtained by Dr. Matthews, but differences in the manner of conducting the experiment will doubtless account for this.——Mr. Harkness discussed the flexure of transit instruments. He pointed out its dependence on the form of the instrument, and also that its amount might be expressed as the sum of two different functions of the zenith distance. The nature of one of these functions can be readily ascertained; but unfortunately that of the other is unknown, and, in a general sense, impossible to determine. For certain classes of instruments it might be ascertained by the assumption of accuracy in tables of star positions, but Mr. Harkness declared that he knew of no way by means of which the problem could be completely solved for the astronomical observatory. Discussion of this paper was prevented by the operation of a rule of the society, in obedience to which it closes its session promptly at ten o'clock. In a general way, it cannot be denied that a strict compliance with this rule has many advantages. A visitor to the society may be certain that he will not be obliged to wait for more than a minute or two after eight for its beginning, and, however uninteresting to him the dissertations to which he listens may be, he may console himself by the reflection that a limit is set to their duration.

Academy of natural sciences, Philadelphia.

Oct. 20.—A communication was read from Mr. W. N. Lockington on the causes of elevation and depression of the earth's surface, with special regard to the setting of loosely compacted sediments by pressure of superincumbent beds. Some have supposed that the great beds of ice which encumber the poles bear down the surface rocks of the region by their weight. It is, of course, possible that a downward movement of the earth's crust may be caused by strata piled upon it; but as the earth's contraction is a sufficient cause for all such movements, it is useless to postulate other causes. The extreme of possible compactness, however, is reached in the sediments themselves by the

pressure of their own bulk. When leaves, stumps of trees, etc., are found in a delta several feet below the sea level, subsidence by a downward movement of the earth's crust is usually invoked as a cause. It is forgotten that the weight of the upper strata of the delta has consolidated the lower, and gradually pressed them down. We know that a dirt bed in the older strata is but a line, while existing dirt beds are many inches or even feet in thickness. Sand becomes sandstone by pressure, but a hundred feet of sand will by no means form a hundred feet of sandstone. The alternations between fresh water and marine strata, the changes from land to shallow lake or sea, which marked the age of the coal-measures and caused the production of coal, need not have been, and probably were not, caused by the alternate rising and sinking of the actual crust of the earth. It is far more likely that they were produced by the settlement or consolidation of the strata themselves. Regularity of settlement would depend on regularity of deposition, which was impossible from the nature of the case. The deposition of vegetable material and the formation of coal were dwelt upon.——Prof. Heilprin remarked that geologists regarded the alternation of coal and dirt beds as indicating recurrent periods of stability, rather than alternating depression and elevation. The stability of the ocean bed and the formation of deltas were considered.——Mr. Jos. Willcox described the effects of glacial action as observed by him north of the St. Lawrence. The farther north we proceed, the less soil would be found on the rocks, depending on the lessened amount of moraine deposited by the glacier as it retreated toward the pole. The scorings on the rocks in the region visited by him were from the northeast to the southwest. He believed that the oldest or Laurentian rocks were at one time covered with sedimentary deposits which had been worn away by glacial action. In some places patches of such deposits containing fossils were yet to be found.——Prof. Heilprin believed that the truth was yet to be ascertained regarding the direction of glacial movement in Labrador. He was inclined to believe that glacial action started below the great circumpolar ice-sheet, and proceeded both south and north from the point of departure. He referred to his communications made some years ago, in which he objected to the belief that glacial action, as we know it, was owing to movements of a large body of ice from the north pole. The results of the most recent arctic investigations on the condensation of moisture and the existence of a cloud limit were given.

Publications received at Editor's Office, Oct. 19-24.

Addresses at the complimentary dinner to Dr. Benjamin Apthorp Gould, Hotel Vendome, Boston, May 6, 1885. Lynn, *Nichols pr.*, 1885. 40 p. 12°.

Allen, A. H. Commercial organic analysis. 2d ed. Vol. i. Raleigh, N. C., *The author*, 1885. 12+476 p., illustr. 8°. (New York, Scribner & Welford.)

American association for the advancement of science. Report of the committee on indexing chemical literature. 5 p. 8°.

Ball, R. S. The story of the heavens. New York, *Cassell*, 1885. 20+551 p., illustr., 16 pl. 8°.

Bettany, G. T. Eminent doctors: their lives and their work. 2 vols. London, *Hogg*, 1885. 10+311, 6+318 p. 12°. (New York, Scribner & Welford.)

Boulger, D. C. Central Asian questions. Essays on Afghanistan, China and Central Asia. London, *Unwin*, 1885. 16+457 p., portr., maps. 8°. (New York, Scribner & Welford.)

Buchwald, G. v. Deutsches gesellschaftleben im endenden mittelalter. Band i.: Zur deutschen bildungsgeschichte. Kiel, *Homann*, 1885. 12+228 p. 12°. (New York, Westermann.)

Classen, A. Handbuch der analytischen chemie. 3d ed. Theil ii.: Quantitative analyse. Stuttgart, *Enke*, 1885. 10+411 p, illustr. 8°. (New York, Stechert, $3.)

Cohn, G. System der nationalökonomie. Band i.: Grundlegung. Stuttgart, *Enke*, 1885. 10+649 p. 8°. (New York, Stechert, $4.40.)

Dancy, F. B., and **Battle**, H. B. Chemical conversion tables for use in the analysis of commercial fertilizers. Raleigh, *The authors*, 1885. 42 p. 8°.

Dargun, L. Egoismus und altruismus in der nationalökonomie. Leipzig, *Duncker & Humblot*, 1885. 107 p. 8°. (New York, Stechert, 90 cents.)

Dawson, J. W. Egypt and Syria, their physical features in relation to Bible history. London, *Relig. tr. soc.*, 1885. (By-paths of Bible knowl., vi.) 12+192 p., illustr. 12°. (New York, Scribner & Welford.)

Disinfectants and their use. New York, *Allison*, 1885. 168 p. 12°.

Etheridge, R. Phillips's manual of geology, theoretical and practical. Part ii.: Stratigraphical geology and palaeontology. London. *Griffin*, 1885. 24+712 p., [26] pl., map. 8°. (New York, Scribner & Welford.)

Ewald, A. C. Studies re-studied; historical sketches from original sources. London, *Chatto & Windus*, 1885. 374 p. 8°. (New York, Scribner & Welford.)

Finch-Hatton, H. Advance Australia! London, *Allen*, 1885. 6+392 p., illustr., map. 8°. (New York, Scribner & Welford.)

Greswell, W. Our south African empire. 2 vols. London, *Chapman & Hall*, 1885. 24+317, 323 p., map. 8°. (New York, Scribner & Welford.)

Habenicht, H., **Domann**, B. und **Lueddecke**, R. Spezialkarte von Afrika. 10 blatt. Lieferung i. Gotha, *Perthes*, 1885. 1:4,000,000. (New York, Christern, $1.10.)

Hager, H. Chemische reactionen zum nachweise des terpentinöls in den ätherischen ölen, in balsamen, etc. Berlin, *Springer*, 1885. 166 p. 8°. (New York, Stechert. $1.50.)

Hartman, W. D. Descriptions of new species of Partula and a synonymic catalogue of the genus. [Philadelphia, *Proc. Acad. nat. sc.*, 1885.] [21] p., illustr. 8°.

Hartmann, E. v. Moderne probleme. Leipzig, *Friedrich*, 1886 (1885). 14+250 p. 8°. (New York, Christern, $1.90.)

Haushofer, K. Mikroskopische reactionen. Braunschweig, *Vieweg*, 1885. 8+162 p., illustr. 8°. (New York, Stechert.)

Helmholtz, H. L. F. The sensations of tone as a physiological basis for the theory of music. 2d Engl. ed. Transl. by A. J. Ellis, London, *Longmans, Green & Co.*, 1885. 20+576 p., illustr. 4°. (New York, Scribner & Welford.)

Henfrey, H. W. A guide to the study of English coins, from the conquest to the present time. Revised edition by C. F. Keary, London, *Bell & Sons*, 1885. 24+325 p., illustr. 12°. (New York, Scribner & Welford.)

Henshaw, S. List of the Coleoptera of America north of Mexico. Philadelphia, *Amer. entom. soc.*, 1885. 4+161 p. 8°.

Holland, T. E., *ed.* The European concert in the eastern question. Oxford, *Clarendon pr.*, 1885. 12+367 p. 8°.

Holst, H. v. Das staatsrecht der Vereinigten Staaten von America. Freiburg, *Mohr*, 1885. (Marquardsen's handb. öffentlichen rechts, b. iv., abtheil. iii.) 10+189 p. 8°. (New York, Stechert, $2.20.)

Holtzendorff, F. v., *ed.* Handbuch des völkerrechts. Band i.: Einleitung in das völkerrecht. Berlin, *Habel*, 1885. 12+524 p. 8°. (New York, Stechert.)

Huebschmann, H. Das Indogermanische vocalsystem. Strassburg, *Trübner*, 1885. 192 p. 8°. (New York, Stechert.)

Jackson, L. D'A. Aid to engineering solution. London, *Longmans, Green & Co.* 1885. 145+582 p., illustr. 8°. (New York. Scribner & Welford.)

Ketteler, E. Theoretische optik gegründet auf das Bessel-Sellmeier'sche princip. Braunschweig, *Vieweg*, 1885. 14+652 p., illustr., 4 pl. 8°. (New York, Stechert.)

Killing, W. Die nicht-Euklidischen raumformen in analytischer behandlung. Leipzig, *Teubner*, 1885. 12+264 p., pl. 8°. (New York, Stechert.)

Laing, S. Modern science and modern thought. London, *Chapman & Hall*, 1885. 12+320 p., illustr. 8°. (New York, Scribner & Welford.)

Landois, L. Lehrbuch der physiologie des menschen einschliesslich der histologie und mikroskopischen anatomie. 5th ed., abtheil. i. Wien, *Urban & Schwarzenberg*, 1886 (1885). 240 p., illustr. 8°. (New York, Stechert, $1.90)

Lansdell, H. Russian Central Asia, including Kuldja, Bokhara, Khiva, and Merv. 2 vols London, *Low, Marston, Searle & Rivington*, 1885. 32+684, 16+732 p., illustr., portr., maps. 8°. (New York, Scribner & Welford.)

Leyden, E. und **Pfeiffer**, E. Verhandlungen des congresses für innere medicin. Vierter congress, gehalten zu Wiesbaden, April, 1885. Wiesbaden, *Bergmann*, 1885. 22+470 p., illustr., 8°.

McGee, W. J. Map of the United States, exhibiting the present status of knowledge relating to the areal distribution of geologic groups. (Preliminary compilation.) Washington, *Government*, 1885. 1:7,115,000.

SCIENCE.—SUPPLEMENT.

FRIDAY, OCTOBER 30, 1885.

MASSACHUSETTS LABOR STATISTICS.

THE sixteenth annual report of the Massachusetts bureau of labor statistics offers a good example of the modern method of treating social questions. It aims to establish the conduct of the commonwealth toward the laboring class on facts and safely drawn conclusions, not on theories and speculations. It is perhaps the most typical fact in the modern aspect of the state toward the workingman, that there exist bureaus of labor statistics.

A very painstaking piece of work is the tabulation of 'Wages and prices' from 1752 to 1860 in this country. The tables give (1) the price for each year of the staple articles, (2) the price of these articles from year to year, and (3) a convenient summary of the changes in prices by periods of about ten years. The value of these tables must depend largely on their great usefulness to future work in this direction. They form the text from which quite a various number of lessons may be read.

The industrial history of the country may be made to fall into three periods.

(1) The early industrial period, previous to about 1815. This period serves as a background from which future prosperity stands out the more boldly. It is a period of hand labor; of few industries; of no specialization—each artisan going through the whole series of processes of his craft; with little money, so that barter was a great factor in the mechanism of exchange; with little education for the workingman, and a more absolute control of his welfare in the hands of the employer, who not seldom took an undue advantage of his position.

(2) The period of transition (1815–1830), characterized by a gradual dissolution of the old and a gradual adoption of the new; from which finally resulted

(3) *The present period.* The first great fact which stamps this period is the development of invention. New forces were employed and labor saved; natural products were adapted to serve human wants, and waste utilized. From 1841 to 45, 2547 patents for inventions were issued; in 1856–60, 18,479. In 1855 an annual product of one million dollars (in 1875 of three million), was made by the rubber interest of Massachusetts, which thirty years before was mere waste caoutchouc gum. Specialization completely transformed the methods of labor. Each man makes one thing alone; by this means his share of the amount produced is enormously increased. In 1855 each operator in a shoe factory (under the old *régime*) produced 455 pairs of shoes; in 1875, 1205 pairs; while the average wages have risen from $205 per year to $397, and the actual time of employment has decreased 12 per cent. The introduction of machinery utilizes ignorant labor, and does not create it, as is often supposed. The lowest industrial class is thus raised in the social scale. The daughters of American farmers and mechanics were formerly the operators. Now skilled labor is not required. Accordingly their places are taken by a more ignorant class, while they move upward to higher callings, in which their entire mode of life is better than that of their predecessors.

A second great difference between the present period and its forerunners, is the change in the status of the laborer before the law. The government now limits the hours of work, prevents the employment of minors, abolishes imprisonment for debt, exempts the workman's tools from attachment, provides fire-escapes, authorizes co-operative associations, extends the benefits of free education, and much besides. The "difference in scale of living between the employer class and the laborer of the early period was far less than that between the workman of to-day and his predecessor." The tables tell the same story. The general tendency, broken only by temporary fluctuations, has been toward a rise in wages. The workingman of to-day is paid better, has more time to himself, and, in many cases, has even an increasing share of the net product of his labor. Prices, however, have advanced, and the final question is, have the wages increased more than the prices? The general increase in the wages, as shown by comparing the periods ending 1830 and 1860, is 52%, while the increase in prices averages 13%. Since 1860 the Massachusetts workmen may be said to have gained a 'pecuniary betterment' of over 10%.

In the last paragraph we reached the true test of the welfare of the workman: the relation between wages and prices. To this question, the essay on the 'comparative wages and prices' in Massachusetts and Great Britain, from 1860–83, is a valuable contribution. This essay is a condensation of three previous reports by the labor bureau,

and gives the whole matter in a concise and useful shape.

In the first investigation 24 industries were compared; and the average of different modes of computation leads to the result that, in general, wages are 62% higher in Massachusetts than in Great Britain. In those cases where pay-rolls could be compared, the average weekly pay was $10.82 in Massachusetts, and $5.48 in Great Britain. We must remember, however, that the number of working hours is 12% greater in Massachusetts. The average wages per hour show a gain of 71% in favor of Massachusetts. Women's wages, as also those of young persons and children, show a gain of 59% in favor of Massachusetts. The next investigation covered 90 industries, and considers the wages of at least 1,250,000 of employés. The wages in Massachusetts are 77% higher than in Great Britain. Besides wages have increased since 1860 in Massachusetts by 28%, in Great Britain by 10% since 1872.

The other side of the question is represented by the cost of living. Our sources of information are prices and workingmen's budgets of expenditure. Prices are higher in Massachusetts (for everything except provisions) on an average of 43%. The average family in Great Britain is slightly larger, but a slightly larger proportion of the family are at work, thus making a direct comparison with the Massachusetts family perfectly fair. In Massachusetts the earnings per family are 55% higher than in Great Britain; the former saves 6%, and the latter 2%, of its income. The expenditures for 1883 of the two families are $754 and $508. If we consider the articles of expenditure, we shall find a remarkable harmony with an economic law demonstrated by Dr. Engel (Royal statistician at Berlin). This law says, 1. the greater the income, the smaller the relative percentage of outlay for subsistence; 2. the outlay for clothing remains uniform, as also; 3. does that for lodging, rent, fuel, light; 4. the outlay for 'sundries' becomes greater as the income increases. The agreement between the calculated and actual values for each item of the expense is very close, the average deviation being less than 3%. The table further teaches that the prices of articles entering into the cost of living were 17% higher in Massachusetts in 1883; of this 11% is due to higher rents in Massachusetts, leaving 6% as indicative of the higher cost of living in Massachusetts. As a final conclusion we have that the standard of living of Massachusetts workingmen to that of the workingmen of Great Britain is as 1.42 to 1. That is, while the cost of living is higher, the wages are still so much higher than those in Great Britain as to leave a margin for better living and even greater saving.

Another portion of the volume deals with the problem of Sunday labor. The questions are these: Has the Sabbath become a necessary element in modern industry, and is its abolition connected with serious evils or not? The departments in which Sunday labor is done are considered one by one. By far the greatest share of Sunday labor is done in connection with railroading. All the roads began without Sunday labor, but street cars and steam railways alike were forced to Sunday labor by public demand. The trains are run for convenience rather than for profit. While the employés generally declare that they would rather have the day of leisure than the additional wages, still the usual effects of overwork seldom occur. The important consideration is this: Sunday labor is not productive labor, but is labor for personal service, and such occupations do not call for constant exertion. If the weaver had to stand at his loom for seven days of the week, he would probably break down; but the car-conductor does it without physical deterioration. The proportion of Sunday laborers to the laboring community is probably larger than one would suppose, 32% of working females and 11% of males doing work on that day.

THE ASCENT OF POPOCATAPETL.[1]

DURING the conquest of Mexico by Cortez, some of his followers ascended this volcano to obtain sulphur with which to renew their exhausted supply of powder. The ascension of Popocatapetl, as compared with that of other great mountains of the world, presents no unusual difficulties, and in the course of the present century, many parties have accomplished it with entire safety, especially since the attention of the commercial world has been called to the great value of the sulphur deposits there.

The ascent is always undertaken from the northwest side of the mountain, starting from the town of Amecameca, which lies on the railroad from Mexico to Morelos. From here a horseback ride of three or four hours brings the traveller to the rancho Tlamacas, just below the snow-line, and from this point the ascent is continued on foot. The party is provided with alpenstocks, and a sort of primitive sandals called *guaraches*, drawn on over the boots to prevent slipping. A peon goes ahead and hews steps in the hard-frozen snow; the others follow in Indian file, pausing every now and then to rest, as the exertion in the extremely rarefied atmosphere is very exhausting.

After the summit is reached, the view, if the

[1] Condensed from an article by Carlos von Gagem, in the *Deutsche rundschau für geographie und statistik*,

weather is clear, amply compensates for all the difficulties of the ascent. At the feet of the spectator lies spread out like a map the beautiful plateau of Anahuac, over eighty miles long, with its four lakes, and more than 200 cities, villages and haciendas, including Mexico the capital, Puebla, Cholula, Atlixco and Tlaxcala, surrounded by snow-covered mountains, among which rise the peaks of Ixtaccihuatl, only eight miles distant, Malinche, and farther toward the east, Orizaba.

The view of the interior of the crater is always completely obscured by the sulphur vapor, which constantly rises from the openings in the bottom, called *respiraderos*. It is at first of a greenish color, then condenses and falls in yellow drops, and finally forms into beautiful crystals. The edge of the crater is composed of immense blocks of porphyry and basalt. To descend into the crater, one follows a path leading downwards from the summit among ice-covered rocks, till a huge block of basalt is reached, which serves as a support for the primitive machine, called *malacate*, which is used here, as in most of the mines of Mexico, for the perpendicular descent of the remaining distance. A strong beam projects a few feet horizontally over the abyss ; over a pulley in the end runs a long rope with a loop in the lower end. The person wishing to descend stands in the loop, holds the rope in one hand, and with the other manages a stick, to protect himself from injury by swinging against the rocks. Two peons let the rope run slowly out over the pulley, and in this way the descent is accomplished. The rope is over 250 feet long, and the descent occupies ten or fifteen minutes.

The crater has the form of a funnel. The bottom is composed of scoriæ, which glitter with various colors, and among which are the *respiraderos*. In one place is a stone so large that a man can stand upon it, which rises and falls as it feels the effect of the subterranean vapors. At the lowest point is a lake, the water of which has a sulphurous and also somewhat acid taste.

The descent of the mountain is, of course, very much easier and quicker than the ascent ; that of the snow-cone especially is accomplished in a very summary manner, familiar enough to a New Englander, to be sure, but rather startling in its novelty to inhabitants of the southern countries. An Indian sits on the forward end of a mat, holding a stick upright between his legs ; the traveller sits behind, clinging to the guide with hands and legs, and in less time than fifteen minutes the distance is traversed, which in the ascent occupied three or four hours.

According to the latest measurements, the height of Popocatapetl is 17,809 feet above the sea-level. The crater is about 2½ miles in circuit, and has a depth of 1,000 feet. Since the mountain has given out sulphurous vapors for centuries, and at the present time something like a ton of sulphur is deposited daily, the amount of the mineral existing there is almost beyond estimation. It would hardly be an exaggeration to say that the upper part of the mountain is an immense block of sulphur, enclosed in a shell of rock a few yards thick.

Three qualities of sulphur are obtained by the operations here. The best is almost chemically pure, obtained at the *respiraderos*, whence it issues in a liquid state and hardens as it cools. The other two qualities are known as rich and poor sulphur-ore. The former yields from 82 to 87 per cent of pure sulphur, the latter about 50.

The process used for the purification of the sulphur is that of Michel, with the apparatus improved by Lamy. The distillation takes place in six large cast-iron kettles, or half-cylinders, which take the place of retorts, and a large brick chamber which serves as the receiver.

Since the sulphur of Popocatapetl is much superior to the Sicilian, it is in greater demand in the American markets. The works at Tlamacas have control of enough water and fuel to increase their productiveness considerably. This would be in every respect advantageous ; aside from the consumption of Mexico, the United States use 200,000 tons annually, and even if every ton were sold 20 per cent below the usual price, there would still be, after allowing for freight and all other expenses, a clear profit of two dollars a ton. The expenses of production are very small. The workmen receive only about 75 cents per *arroba* (25 pounds), although their work is laborious, dangerous on account of the constantly falling rocks, and from breathing the sulphurous vapors very deleterious to the health, causing in a short time, among other inconvenience, the falling out of the teeth.

The principal source of the world's supply of sulphur at present is Sicily, which produces four-fifths of that consumed. The deposits of Popocatapetl are greater than those of Sicily, and, as already stated, of better quality. It seems incredible that they have not been more thoroughly worked, especially as this sulphur can be brought to market 25 per cent cheaper than the Sicilian, at least in the United States.

A plan is now on foot to lead a tunnel through the wall of the crater directly to the sulphur deposits, and connect its mouth by a narrow-gauge railroad with Amecameca, which is on one

of the main lines of the country. The capital is forthcoming, and it is quite likely that in a few years this mountain, which is of such great interest in geologic, topographic, and artistic respects, will have acquired an almost incalculable industrial importance.

NATURAL ENEMIES OF OYSTERS.

MAN in former times, and even at present in some localities, might be classed with the enemies of the oyster. But now, when he is introducing artificial means for their multiplication, instead of an enemy he becomes their protector. There are animals, harmless-looking and small, which do far more damage to this delicious shell-fish than man, and that, too, without giving anything in return. The many which are destroyed by human agency become few when compared to those killed by their smaller foes.

The oyster, although protected by a very hard shell that can be closed almost hermetically, is, on the whole, rather poorly defended, for there he lies right on the open bottom, exposed to everything that may chance to come along, without any power to move away and crawl into some crevice, but destined to remain motionless while attacked. Two kinds of animals do the most damage: one the common star-fish (Asterias Forbesii), the other a univalve spiral shell-fish, called by oystermen the 'drill' (Eurosalpinx cinerea).

A star-fish approaches its victim, slowly crawls upon it, and then bends its five arms around the shell. The mouth of a star fish is so small that an oyster a quarter of an inch long could not be taken into it. So what does it do, when its arms are encircled around the large oyster, but begin to project its stomach out of its mouth and surround the oyster with its stomach entirely outside of the body. Then the oyster gradually opens its shell, leaving the star-fish to do as it pleases. After a while the star-fish moves off, and we see that a large part of the oyster is gone. When the stomach is first protruded a liquid is excreted which seems to have the power of either killing or weakening the oyster. Just as soon as the shells are open digestion is begun by the star-fish, and after a short time the hunger of the star-fish is satisfied and the oyster is dead. Before long the star-fish feels like another meal, and he attacks another oyster, leaving the old one as prey to small crabs and shrimp. And so it goes on day after day, thousands operating in the same manner. At times they come in immense swarms from deeper water, in a single night entirely destroying a large bed. In brackish water they do not flourish, but in the almost pure ocean water found in some oyster-raising districts the destruction is immense, and there is no remedy.

If some shell-fish for which the star-fish have a preference could be introduced among the oysters, perhaps the devastation might be partially checked. Oystermen formerly had the stupid habit of tearing every star-fish that happened to come in their way into pieces, throwing the fragments overboard. They were not aware that each arm had the power of reproducing the remaining four arms and becoming a perfect star, so that each time one was torn into two or three pieces, two or three new individuals were formed.

The other enemy, the so-called 'drill,' is well named, for its peculiar operations are based upon its boring or drilling powers. Although seldom an inch long, it can bore a hole through the hard shell of an oyster with surprising speed. The hole is always smooth and about in the same place, a spot covering a vital part being the point attacked. Similar 'drills' operate on other species of shell-fish, and their deadly marks can be seen on the valves of the shells which are washed upon our beaches. In any collection of shells, and on any beach, numerous examples of the neatly-drilled hole can be found.

In the soft animal part of the 'drill' there is a little tube-like proboscis which encloses another proboscis. Over the end of the latter there runs a little ribbon which is covered with teeth. This ribbon, or odontophore, is attached at each end on the two opposite sides of the inner proboscis. By means of muscles at the base of each end of the ribbon it may be pulled back and forth over the end of the snout, with the teeth projecting outward. When the oyster is to be attacked, the end of the snout is pressed against that part of the shell to be bored, and the muscles begin to work the toothed strap. The teeth rasp away at the shell, each time removing particles of calcareous matter until a hole is bored. Then the rasp acts upon the flesh inside, and as the meat is removed it is drawn to the mouth and eaten.

The 'drill,' after eating a meal, leaves its victim, and later attacks another. By the time it has finished its meal the oyster is dead, and its shell flies open, leaving the rest to crabs and shrimp. Filing away upon the hard shell wears the teeth away rapidly, but this is remedied by nature, for one end of the strap is gradually absorbed, while from the other end a new supply of toothed ribbon is being formed. So, on one side of the proboscis, there are fresh unused teeth; on the other side, old worn ones; and on the end, teeth just being worn; and the whole gradually moving away to one end, to be absorbed while other fresh ones are being formed.

RALPH S. TARR.

THE ACTION OF COLD ON MICROPHYTES.[1]

PROFESSOR MCKENDRICK, of Glasgow, gave at the recent meeting of the British association an interesting account of the methods of trying to destroy small organisms like bacteria, not as is commonly done by heat, but by cold. It is known that by means of Coleman's cooling machine meat may be kept from putrefying for a considerable time, but in attempting to sterilize a putrescible solution by means of cold, it was found that, though in some cases putrescence was delayed, in no case were the organisms completely destroyed. Organic fluids were exposed to temperatures more than 120° below 0° F., but on thawing they were found to contain living organisms still. Thus the hope of preserving putrescible matter by means of cold—an important economical result—is, so far as investigation yet goes, destroyed. The organisms under cold seem to be in a nearly solid state, though we cannot call it a chrystalline state. In a paste solution the water is chrystallized under cold, the paste remaining spongy. Possibly cold may separate from these minute organisms the water they contain, and this water is again absorbed on thawing. Meat under cold becomes very friable, while yet minute fragments of it show the same microscopic constitution of muscle. It is well known that frogs have been found in blocks of ice and been revived. Frogs have been frozen at 20° F. in about half an hour. On thawing slowly, the animal, in two instances, completely recovered. When it was frozen for longer than half an hour it did not recover; but, though reflex action was gone, there remained some irritability both in nerves and muscles. It was found also that certain vital functions may be arrested by cold, and thus conceivably higher organisms may be kept vitally inert for an indefinite time. Experiments were also tried on warm-blooded animals. A rabbit subjected to a temperature 100° below 0° F. recovered. No temperature lower than 73° below 0° F. has been obtained in free atmosphere.

PRELIMINARY REPORT OF THE COMMISSION APPOINTED TO REPORT ON THE SPANISH EARTHQUAKES.

THE commission appointed by the Spanish government to investigate the Andalusian earthquake of December 25, 1884, has made a preliminary report of its labors and conclusions up to March 7, 1885 (*Terremotos de Andalucía*, Madrid, 1885, 107 p.). This report is based upon a personal examination, which the members of the commission made of the region affected, and upon some thousands of answers received in response to a series of interrogations which were widely distributed. A more detailed discussion of their work is to follow at a later date. This report, however, deals quite fully with the matter in hand, and states conclusions which, although often only negative, are yet of considerable interest. We must be content with presenting here a brief *résumé* of its contents.

Beginning with a statement in seven pages of the theories proposed by various writers to account for earthquakes, classifying them as volcanic or non-volcanic, and attributing them to the internal heat of the earth, to the presence of vapors of high tension, or to the solution of the rocks by subterranean waters; it proceeds to give in seven pages more a description of the orography and hydrography of the two provinces of Granada and Malaga, and then devotes twenty-one pages to the geology of the same district, describing in detail the rock formation, with the location and direction of its principal fault lines.

Coming to the present occasion, a brief discussion of the times observed at different places leads only to the conclusion that the origin is to be sought to the west of Granada and east of Malaga, any exact result being vitiated by the uncertainty of the time data; this being due to the lack of good clocks and to the fact that, in places where much damage occurred, the attention of the inhabitants was pretty thoroughly occupied with caring for their own safety. The area affected is described as limited toward the north by Madrid and Segovia, toward the west by Cáceres and Huelva, toward the east by Valencia and Murcia, and on the south by the Mediterranean; but the tremor of the earth was also indicated by instruments even so far distant as Rome and Brussels. Examination of the direction of the cracks in the ground and in buildings, as well as of the curves of intensity, estimated according to the Rossi-Forel scale, leads to the conclusion that the focus is to be found in the valley of Zafarraya, where the greatest damage was caused.

The latter half of the report is mostly occupied with the phenomena preceding, accompanying, and following the earthquake, such as, changes in the course of streams, perturbations of magnetic apparatus, barometric depression preceding the shock, subterranean noises, dynamic effects, etc. In estimating the amount of damage done, the number of buildings injured in the two provinces of Granada and Malaga is stated as 17,178, of which number 4,399 are classed as totally destroyed. The injured persons were: 745 dead, 1,485 wounded. In discussing the causes of this earthquake, the commission accepts the Italian

[1] From *Nature*.

theories, attributing the earthquake to the tension of vapor of water in the subjacent strata. The valley of Zafarraya, indicated above as the probable focus, is a locality where much water gathers and easily penetrates beneath the surface, and to the vapor of high tension produced from the water here collected in deep-lying strata are attributed the forces which gave rise to the present earthquake. It is assumed that in general the lines of seismic propagation, following crevices in the strata beneath the surface, will accord with the direction of the surface water courses. On this idea, the principal radiant lines from Zafarraya were along the rivers Marchau and Genil; a view which is regarded as confirmed by the phenomena in the Sierras Tejeda, Marchamonas, and Eumedio, where large crevasses occurred parallel to the direction here indicated. In the province of Malaga the principal seismic effects were found in the vicinity of Periana, adjoining the district designated as the focus, but on the other side of the sierra, which separates the two provinces, and here the principal radiant line followed the course of the river Velez.

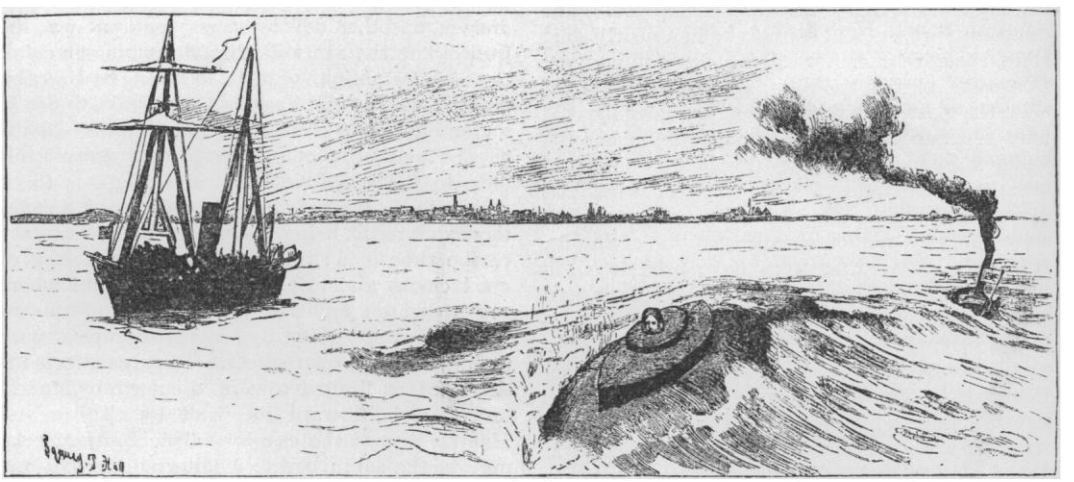
Theoretical considerations suggesting that the area affected should approximate in form to an ellipse, this is found to agree with the observations; but the data at hand do not suffice for any exact determination of the direction and velocity of the movment, nor of the depth of the focus.

In conclusion, then, the report fixes upon Zafarraya as the focus of this earthquake, and suggests a probable cause for it in the subterranean waters gathered there; but more exact results are yet wanting, and may very likely remain so, even when the fuller report is issued. This, however, will be awaited with interest, and will doubtless contain valuable additions to the science of seismology.

The report is signed by Manuel Fernandez de Castro, Juan Pablo Lasala, Daniel de Cortázar, and Joaquin Gonzalo y Tarin.

THE NORDENFELT SUBMARINE BOAT.[1]

JUST before leaving Denmark for the south, the Prince of Wales, with the King and Queen of Denmark and the Czarina, witnessed off Landskrona, a town on the Swedish coast, an interesting and successful trial of the new submarine boat, which has been built at Stockholm upon the plans of Mr. Nordenfelt, the inventor of the machine gun so extensively used in modern warfare. Ever since the American civil war, naval engineers have been striving to solve the problem of submarine navigation, but until now with very little success. Mr. Nordenfelt's invention, however, appears to fulfill the numerous requirements necessary for overcoming the difficulties and dangers of maintaining, driving and directing a boat beneath the water. The boat is built of steel, and is cigar-shaped, with a glass conning-tower in the centre, from which the commander can keep a look-out. This dome is protected by a strong iron cover. There are three engines, one to work the screw in the stern which propels the vessel, and two to work the propellers on either side, which, when set in motion, compel the boat to sink, and maintain her at a certain depth beneath the surface. When it is wished to sink the boat, enough sea-water is taken in to reduce the buoyancy till the



THE TRIAL OF THE NORDENFELT SUBMARINE BOAT AT LANDSKRONA, SWEDEN.

[1] From the London *Graphic*.

tower is just above the surface. The side propellers being then set in motion, the vessel can be sunk to any required depth, there being an automatic arrangement by which the engines are stopped directly that depth is exceeded. An automatic horizontal steering gear also prevents the boat from going down or up headforemost, an even keel being preserved throughout all the manœuvres. Should a breakdown of the engine occur, the boat from its own buoyancy at once rises to the surface. The motive power is steam, and as long as the vessel is above water the fires can be stoked, the smoke being driven through two channels, which pass partly round the hull and point aft. When, however, the boat sinks, the fires have to be sealed, and reserve steam is used, which is kept at high pressure in two tanks. With this the boat has been driven for five hours at a speed of three miles an hour. Her speed on the surface is eight knots. The crew numbers three, and during their submarine existence, they have to subsist on the amount of air which they take with them in the hull, in which four men have subsisted for six hours without any especial inconvenience. The boat is sixty-four feet long, and the central diameter is nine feet. The enormous utility of such a vessel as this in naval warfare is at once apparent. Moving without the slightest apparent sign of existence, she can launch torpedoes against hostile vessels, enter a harbor unperceived, and render useless the most complicated system of submarine mines. The trial at Landskrona was witnessed by officers representing every European power.

FOURTH CONGRESS OF GERMAN PHYSICIANS, 1885.

THE fact that some of the most important work in medical science is being done in Germany, and that at the congress, whose proceedings have been recently published,[1] some valuable additions to medical knowledge were made, warrants a notice in the columns of *Science*.

The first subject discussed by the congress was corpulence. Ebstein advanced the opinion that drugs were of little service in reducing the amount of fat, and that an entire change in the regimen—including both change of diet and of the manner of living—was necessary. Any method which reduced the general nutrition, and thus removed fat, was a failure: the fat alone must be removed. The method must not require the individual to give up his business during treatment, else it would not be generally applicable. The method must be capable of being continued indefinitely without producing unpleasant results, for individuals predisposed to corpulence by heredity or constitution must keep up the diet for a long time. One method is to cut off all fatty foods. But as carbohydrates may be changed into fat in the body, this is not reasonable. The object is rather to prevent the formation of fat in the body. To secure this, it is necessary to regulate the proportion of albuminous, starchy, and fatty foods, so that perfect nutrition shall be secured, but no excess of fat produced. The necessary amount of fat for a healthy man is 142 gr. per diem. If this is reduced one-half, a part of the amount necessary for nutrition will be taken from the body to compensate for the reduced allowance in the food, and thus the excess of fat may be removed. Under this system the individual does not suffer the distress which is felt by those who are cut off from all fatty food, and the results are more successful and agreeable than those secured by the Banting system. The amount of carbohydrates is to be reduced so that no surplus above bodily needs shall be taken. In the Banting system the diet is chiefly nitrogenous, which often causes indigestion. Ebstein gives nitrogenous food, with the reduced allowance of starch and fat in sufficient quantity to keep up the general nutrition and working strength, but not in such amounts as to overload and embarrass the organs which digest proteids. The necessity of muscular exercise of sufficient force to produce free perspiration is insisted upon. This system has met with approval in Germany on account of its success.

Henneberg, in discussing the subject, approached it from a different side, and, by a review of the methods adopted in fattening cattle, sought to deduce the rules necessary to be observed in avoiding the accumulation of fat in man. The general discussion elicited varying views upon the physiology of digestion, but all agreed that the use of medicine for reducing corpulence was to be avoided.

The discovery and demonstration by Lustgarten of a bacillus of syphilis has already been alluded to in *Science*.

Measures to be adopted in combating fever formed the topic of one day's discussion of the congress. The well known property of quinine in reducing fever has led to a search for similar properties in organic substances allied to it in chemical constituents. Benzol, carbolic and salicylic acids, salicin, resorcin, hydrochinon, chinolin, kairin, thallin and antipyrin are such substances, and they have all been found of use as antipyretics. Many of them have, however, unpleasant effects; so that, at present, salicin, kairin, and

[1] *Verhandlungen des congresses für innere medicin.* Vierter congress, 1885. Herausgegeben von Drs. E. Leyden und E. Pfeiffer.

antipyrin are the only ones in general use. Antipyretics may act either by reducing the production of heat, *i. e.*, the oxidation process; or by increasing the amount of heat given out from the body; or by paralysing certain micro-organisms whose action irritates the heat producing mechanism; or by restraining and regulating the action of these heat producing nervous mechanisms directly. It is to the latter theory that Filehne and Liebermeister assent. The latter, to whom is due the use of cold baths in the treatment of fever, admitted that antipyrin was applicable in some cases where the application of cold was unadvisable. But cold baths are not to be given up. A healthy man in a cold bath (68° F.) gives off in ten minutes seven times as much heat as under ordinary circumstances. But his body temperature remains the same. Therefore the effect of the bath is to increase seven times the production of heat in the body. If the bath is long continued the temparature falls slightly. After the bath the temperature falls slightly. The same is true in fever with this difference, that the fall of temperature follows a cold bath more quickly, and to a much greater degree than in health. In many cases this removal of heat by bath is indispensable, even though it is accompanied by an increase in the production of heat, for in fever experience shows that the amount abstracted exceeds the amount produced. According to v. Jaksch, thallin in 0.25 dose produces a fall of temperature more quickly than antipyrin in 1. dose. It is apt, however, to produce a chill and sweat, and its effect is not so lasting as that of antipyrin. Neither of them affects the duration of a specific fever (such as pneumonia or erysipelas), or relieve the distress of the patient. In pneumonia and erysipelas their use prolongs the period of convalescence by reducing the recuperative powers of the patient. They are, therefore, to be used only in cases of fever in which the temperature rises to a dangerous point, or in which cold bathing cannot be used. To this opinion Strümpell of Leipzig agreed. Others maintained that the reduction of temperature gave the patient much comfort, relieving many distressing symptoms. All agreed that the use of cold baths, or cold sponging, was preferable to the use of drugs.

Asthma was the subject of a long and exhaustive discussion, which elicited a number of subdivisions of the affection of some therapeutic importance. Asthma is regarded as a nervous affection, attended by a sudden obstruction to expiration, with dilatation of the lung. It may be a primary disease due to changes in the nervous centres governing respiration. In the majority of cases, however, it is a secondary disease of reflex origin. An irritation arising at some point sets up an excitement of the nervous mechanism of respiration, which shows itself by the attack. Such an irritation may come from the mucous membrane of the nose when that is thickened by chronic catarrh, or covered with polypi, or irritated by some external material, as in hay fever, in which case operative measures on the nasal cavity, or anæsthetics applied to it, will cure the asthmatic attacks. Or the irritation may come from the finer bronchi, and the inflammation of these may set up a spasm, and thus cause the attack, in which case the treatment must be directed toward the bronchitis. The exact character of the spasm attending the attack is undetermined. Some regard it as a spasm of the diaphragm, which prevents this muscle from relaxing, as it normally does, in expiration. This view is based upon the fact that electrical excitement of the nerves to the diaphragm will produce results similar to those occurring in asthma, while excitement of the nerves to the bronchial muscles does not produce asthma. The majority of authorities, however, consider this theory questionable, and hold that a true spasm of the muscular coat of the finer bronchi causes the attack. All admit that the spasm, from whatever cause, is best combated by narcotics, of which morphine and chloral are the most reliable. But treatment of the attack should always be followed by treatment of the cause, especially if that is easily reached, as in cases of nasal catarrh.

Acute articular rheumatism has lately been regarded as an acute infectious disease like pneumonia and typhoid fever. The opinion was advanced by Edlefsen that it developed in certain localities in Kiel more frequently than in others, and he found, in investigating 845 cases, that persons living in certain houses were especially liable to the disease. He concluded that the micro-organism causing the disease is one which clings to dwellings, especially such as are built on damp ground, and advises persons who are subject to frequent attacks to change their residence. Such authorities as Jurgensen and Friedländer agreed to this view, and in support of it cited the fact that in certain barracks and hospitals, cases of acute rheumatism developed in great numbers. All admitted that the mortality had diminished greatly since the use of salicylate of soda was introduced.

A number of shorter papers of value were read, which are not of such general interest as to demand notice. The proceedings of this congress should be followed by all physicians interested in the progress of scientific medicine.

M. A. S.